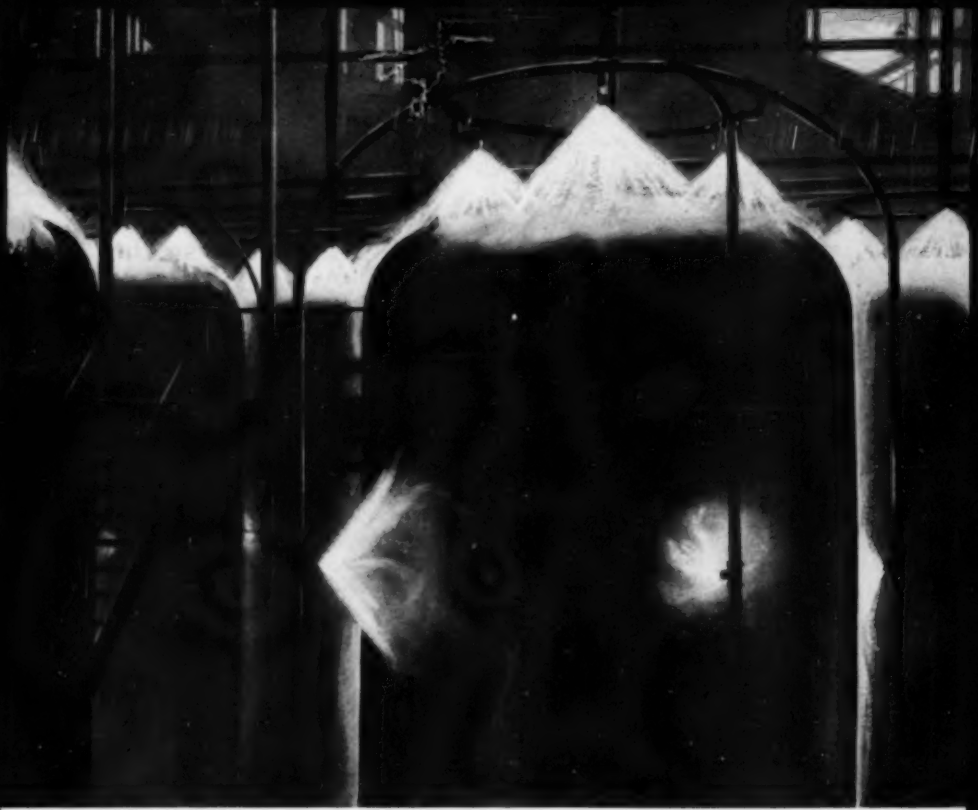
JUNE
1951

Chemical Engineering



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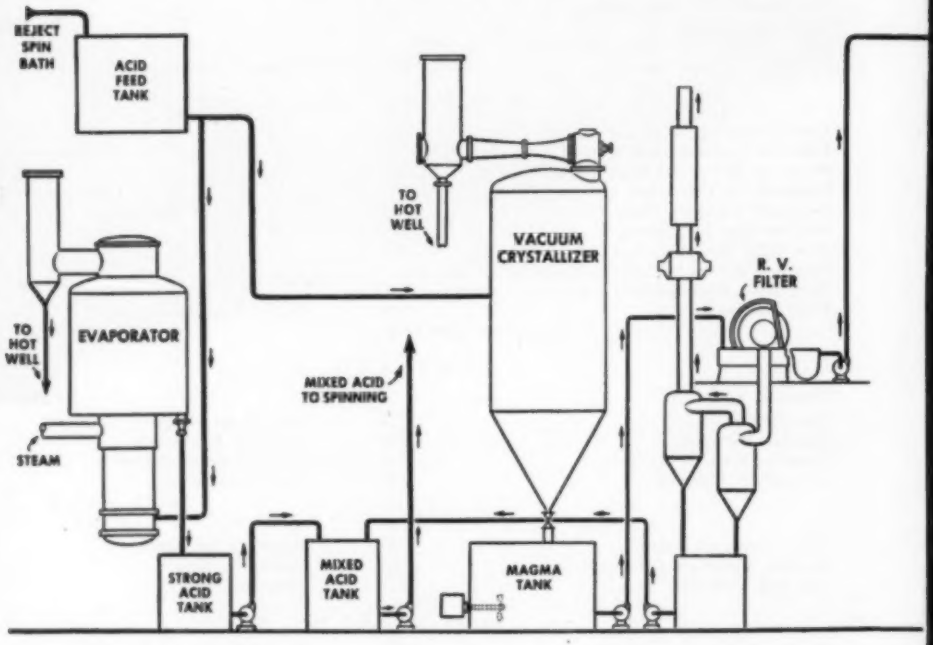

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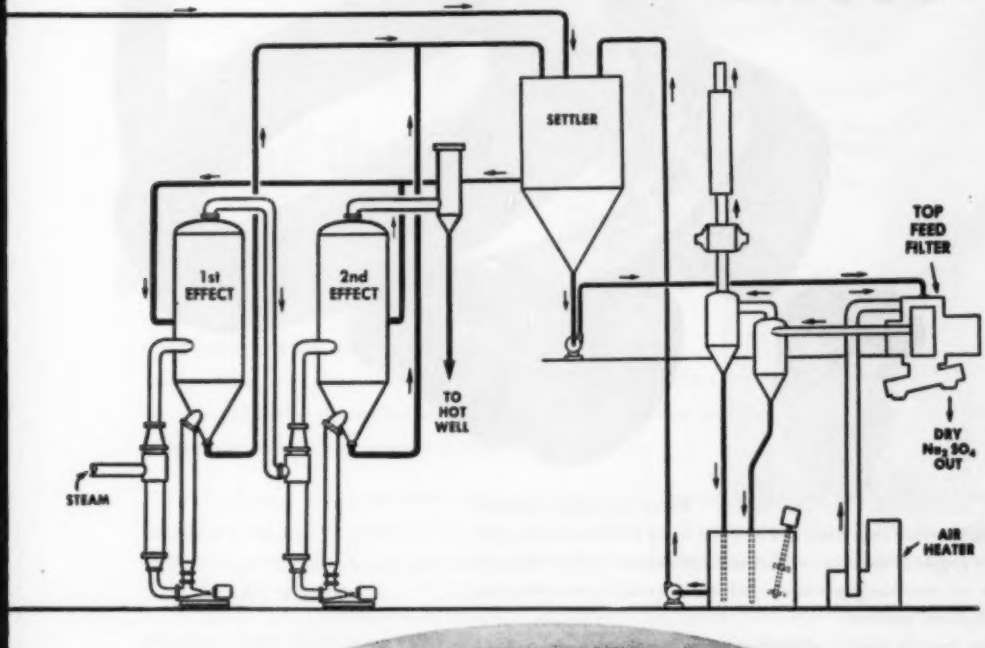

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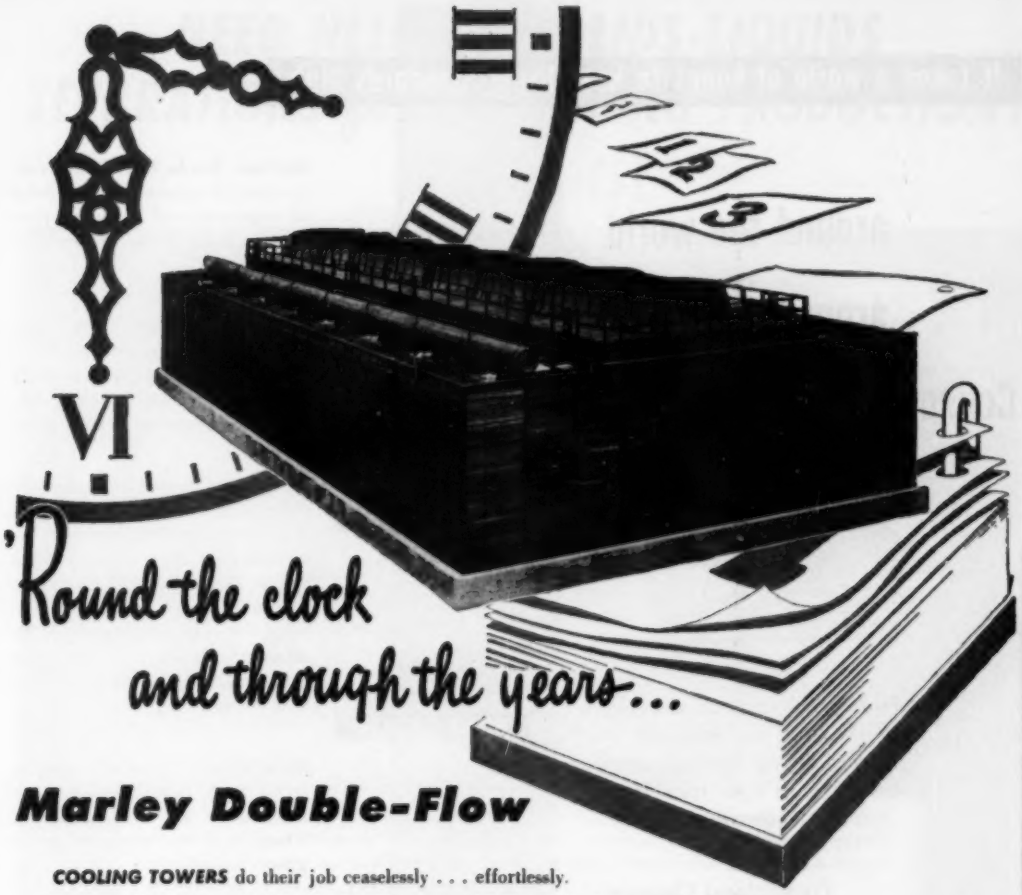

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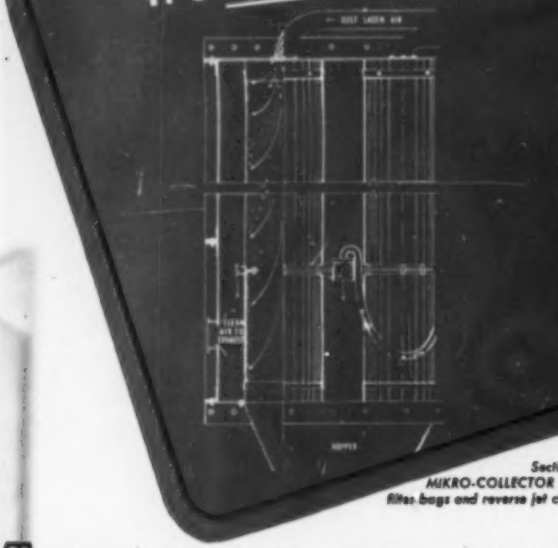

Sectional view of MIKRO-COLLECTOR showing felt filter bags and reverse jet cleaning ring.

10 Reasons

why a MIKRO-COLLECTOR *will best help you win a war with Dust*

1. Phenomenal Filter Rates
2. Highest possible recovery of solids
3. Requires less filter surface, floor area
4. Extreme simplicity, low upkeep, minimum attention
5. Selected wool felt filtering medium
6. Reduced number of filter bags; quick changeover
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The MIKRO-COLLECTOR* has virtually no rival in the collection of radioactive dusts of ultra-fine particle size. For among many other triumphs, it has scored a spectacular record in the handling of such dusts. Its installations for this purpose alone, during the past year, have a combined capacity of more than 100,000 cfm.

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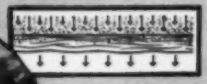
Photo-micrographs illustrate value of wool felt as a superior filter medium.



Photomicrograph (25 diam. enlargement) of special, pressed wool felt . . . Drawing shows how dust particles are trapped by density of felt while air flows through in constant volume.

Photomicrograph (25 diam. enlargement) of ordinary filter cloth . . . Drawing shows how dust can escape through open mesh.

*Patents applied for by H. J. Hersey, Jr. and Pulverizing Machinery Company

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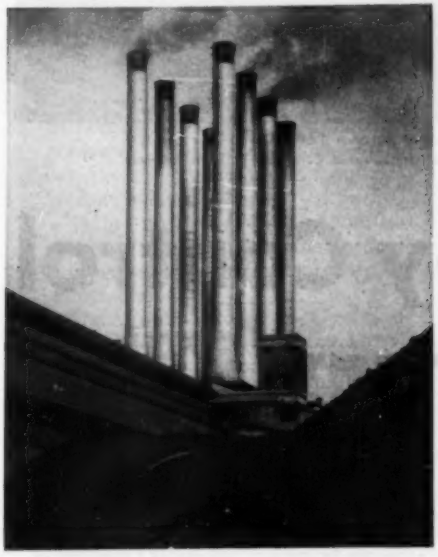

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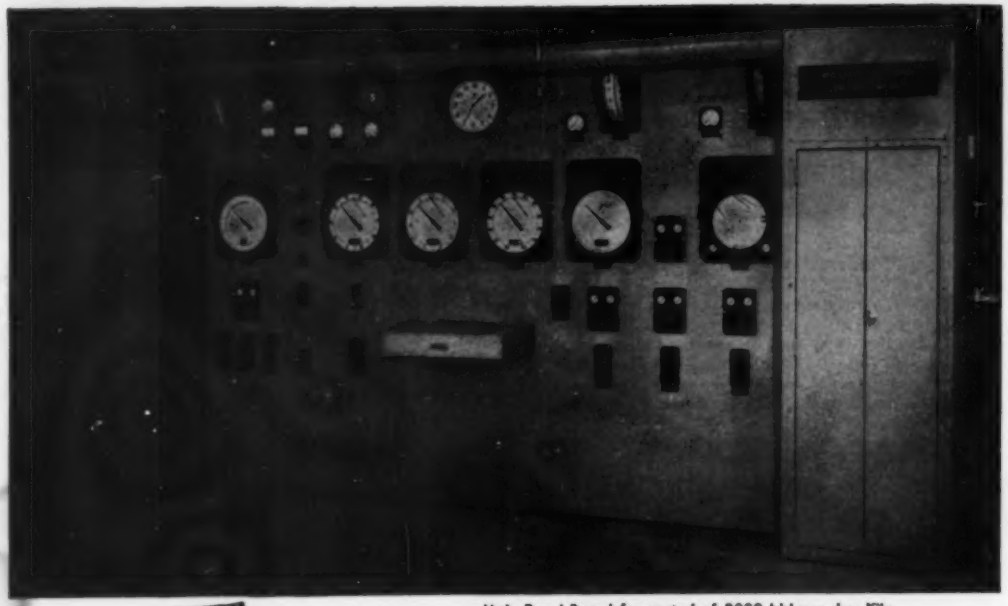

Main Panel Board for control of 3000 bbl per day Kiln at Missouri Portland Cement Company, St. Louis, Missouri.

3 Ways Better

...Bailey Control for Rotary Kilns

Bailey Control for Rotary Kilns gives you better performance three ways:

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By maintaining uniform temperatures and excess air conditions in the kiln, Bailey Controls help to reduce to a minimum costly refractory repairs and wear and tear on auxiliary equipment.

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YOU CAN CLEAN THIS STRAINER

without interrupting production or contaminating the product

Here's *positive* and *100%-continuous* fluid cleaning.

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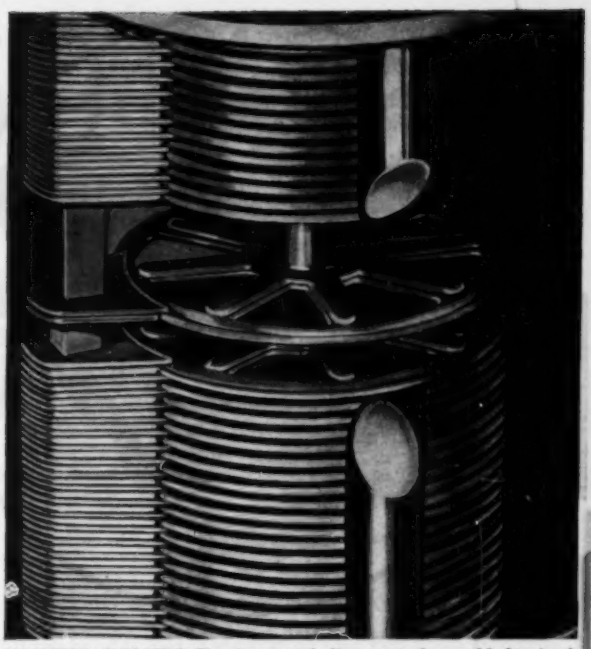

NON-STOP CLEANING Turning metal discs past cleaner blades (periodically by hand or continually by motor or other automatic means) "combs out" all solids—even when imbedded in strainer element—without interrupting flow.

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○ for light weight

○ for insulation at very high temperatures

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Aluminum oxide, as you know, is inherently capable of withstanding very high temperatures—well over 3000° F. We make hollow spheres of Al_2O_3, specially bond them together, and get a finished refractory that has low heat capacity, good load strength, and is one of the best insulating materials available for high temperature jobs. And, a nine inch straight ALFRAX BI brick *weighs only 4.8 lbs.*

These unusual properties have made ALFRAX BI refractories ideal for such diverse applications as: Linings for chemical process kettle settings; Arches for aluminum reverberatory furnaces; Backing-up linings for synthesis gas generators; Arches and sidewalls for ceramic kilns. The one common denominator in each case being high heat — usually above 2600° F. (At lower temperatures, standard materials may prove adequate.)

Do any of these applications strike a responsive chord—perhaps where closer heat control is indicated? . . . or where a reduction in overall lining thickness would pay off? . . . or where a low heat capacity lining is desired?

Whatever your needs, bear in mind that ALFRAX BI refractory is only one of many Super Refractories by CARBORUNDUM — each of which (see box, opposite page) has unique properties ideally suited to certain applications.

Information is now available on all these Super Refractories. So send today for our valuable new booklet. No obligation, of course.

THE CARBORUNDUM COMPANY

Refractories Division **Perth Amboy, New Jersey**

"Carborundum," "Carbofrax," "Monofrax" and "Alfrax" are registered trademarks which indicate manufacture by The Carborundum Company.

refractory material made of bubbles!

SUPER REFRACTORIES ARE ALSO USED

WHERE ABRASION OR EROSION IS SEVERE. Two Super Refractories—CARBOFRAX silicon carbide material and MONOFRAX K fused cast material—are within one index point of diamond hardness! As a result, both are exceptionally resistant to abrasion, either at room temperature or high heat.

WHERE HEAT CONDUCTIVITY IS NEEDED. At elevated temperatures CARBOFRAX refractories conduct heat as rapidly as chrome-nickel steels! This characteristic is invaluable in checkers, muffles, hearths, etc.

WHERE CHEMICAL ATTACK IS LIKELY. In general, all Super Refractories are either neutral or acid in nature—are widely used where chemical inertness is important.

WHERE STRENGTH IS IMPORTANT. No commercial tonnage refractories have greater strength than Super Refractories. All can withstand over 300 psi at 2750° F without crushing.

WHERE HIGH HEAT IS INVOLVED. They can be safely used at temperatures over 3000°F. They are very durable—are highly resistant to spalling and cracking. Some varieties are almost indispensable where flame impingement or violent temperature changes are present.

WHERE SPECIAL SHAPES ARE INDICATED. Practically all Super Refractories are available either as bricks or special shapes molded to close tolerances—including fitted joints, tubes, etc.

Do any of these suggest possible applications?

The important thing about Super Refractories by CARBORUNDUM is NOT just that they are "better" than standard fireclay refractories. The important thing is that they are actually *a class apart*—with many entirely different properties and applications. (For example, some of their properties—such as abrasion resistance—are important *regardless of whether high temperatures are involved.*)

Nor is their principal value simply that they cure trouble-spots where other materials (e.g., refractories, metals, etc.) fail to stand up. Their value usually lies in increasing capacity and reducing overall operating costs. (For example, regenerator checkers made of CARBOFRAX silicon carbide brick absorb and release over 3 times as much heat as checkers made of ordinary refractories when cycles are short.)

WHY NOT CHECK UP? We have a new booklet which outlines the unusual characteristics of these special purpose materials. The coupon will bring you the story—or one of our engineers will be happy to talk over your specific problems. We believe it could be mutually profitable.

This advertisement—one of a series—is presented in the belief that in the unusual properties of the various Super Refractories by CARBORUNDUM lies the key to many new or improved processes. We would like to talk over specific jobs with anyone who sees such possibilities.

Dept. H-61
Refractories Div., The Carborundum Co.
Perth Amboy, New Jersey

Please send your free booklet on properties of Super Refractories.

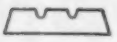
Name_____

Position_____

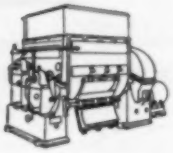
Company_____

Street_____

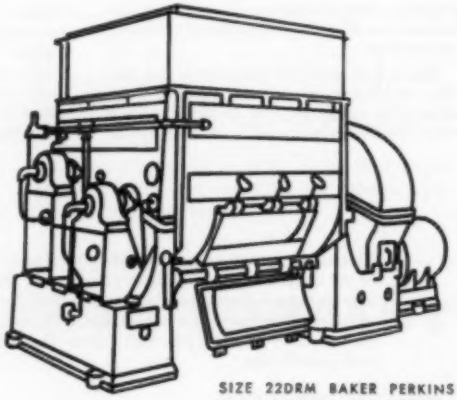
City_____ Zone____ State_____

AIRPLANES ARE NEEDED **AIRPLANES NEED ALUMINUM** 

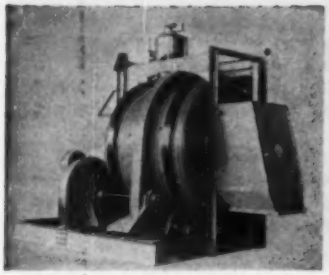
ALUMINUM PRODUCTION NEEDS CARBON ELECTRODES

ELECTRODES REQUIRE MIXING 

Baker Perkins unidor mixers are designed, built and preferred for the rapid processing of carbon electrodes and pot linings for aluminum production either Soderberg or Hall process. For complete confidential data write to Baker Perkins Inc. Chemical Machinery Div., Saginaw, Mich.

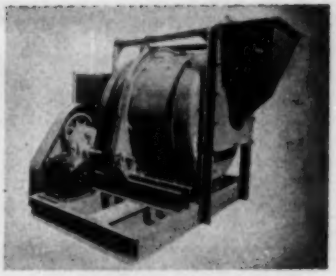


SIZE 22DRM BAKER PERKINS UNIDOR MIXER WITH CAST SIGMA BLADES CORED FOR STEAM.

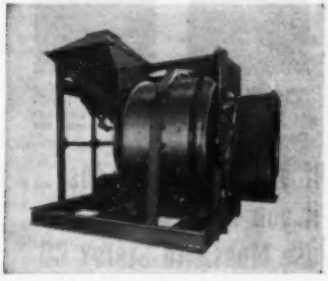


CHEMICALS—Equipped with liquid measuring tank for use in various chemical applications.

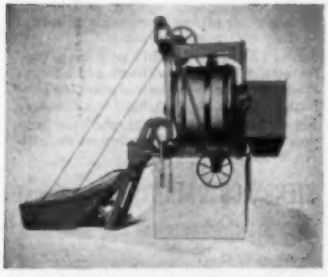
CHEMICALS • DRUGS • PLASTICS • METALS • FOOD • CANDY—Pan is tilted and rotated by motors. Capacities up to 3090 lb.



COMPOSITION MATERIALS • INSULATING AND REFRACTORY CHEMICALS • CLAY • GLASS BATCHES • FOUNDRY CORE SAND—13 cu ft dry mixer on skids.



ENAMEL FRITS • GLASS—50 cu ft dustproof mixer. Fully-automatic, electrically controlled charging and discharging.



FURNACE CHARGES • GLASS BATCHES—28 cu ft mixer with elevating power loader.

How To Straighten Out Your Mixer Problems

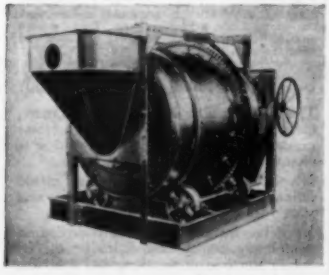
What do you mix? Here's a partial line-up of industrial mixers bearing the famous Worthington-Ransome trademark—which means the right design for every type of mix.

And you'll find in every mixer the following Worthington-Ransome features: *thorough* mixing (or blending) of even the finest dry materials or colors in any proportion . . . *clean* discharge . . . *dustproof* design (where required) . . . *heavy-duty* construction.

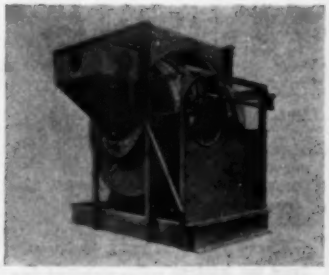
For solution of your particular mixing problem or for free bulletins, write: Worthington Pump and Machinery Corporation, Ransome Industrial Mixer Division, Dunellen, New Jersey.

WORTHINGTON

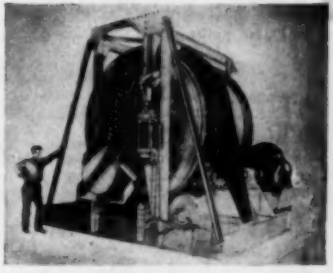
YR.1.1



SOAP POWDER • PIPE TOBACCO • SNUFF—Dustproof mixer for blending and mixing.



FERTILIZER—Standard sizes, ½, 1, 2-ton capacity. Also used for asbestos products, etc.



FURNACE CHARGES—One of the largest industrial mixers—batch capacity of 260 cu ft.

MONSANTO
CHEMICALS — PLASTICS

FOR YOUR INFORMATION

Every month Monsanto publishes these pages of pertinent information which may be helpful to you. This issue discusses:

Intermediates — Plasticizer
Hydraulic Fluid — Detergents

Additional information on any of these subjects will be provided by any Monsanto Sales Office or in response to your request by coupon or letter.

Ortho-nitrobiphenyl, low-cost plasticizer, is available now

In this day of "tight" plasticizer supplies, Monsanto Ortho-nitrobiphenyl (ONB) may be the means of solving several of your problems. A low-cost, primary plasticizer, ortho-nitrobiphenyl (also known as ortho-nitrodiphenyl) is compatible with a wide range of materials. And it is available . . . in quantity . . . *now!*

Ortho-nitrobiphenyl is compatible with the cellulose esters and ethers, polyvinyl chloride, polyvinyl butyral, polyvinyl acetate, styrene, rosin and rosin esters, modified phenolic resins, oil-soluble alkyd resins and vegetable oils. This wide compatibility, plus its low hydrolysis rate and low price, makes ONB an unusually attractive plasticizer.

Most resins, both natural and synthetic, can be plasticized with ONB. The amount of required plasticizer varies with the resins and the use the finished product is to be put to. The volatility of ortho-nitrobiphenyl is less than diethyl phthalate and greater than dibutyl phthalate.

In addition to being an efficient, economical plasticizer, ONB imparts fungicidal properties to textiles coated with ONB-plasticized nitrocellulose, polyvinyl acetate, polyvinyl formal, polyvinyl butyral, cellulose acetate, Vinylite VYHH and styrene.

Ortho-nitrobiphenyl is readily soluble in carbon tetrachloride, mineral spirits, pine oil, turpentine, benzene, acetone, glacial acetic acid and perchlorethylene. It is a good solvent.

For further information on Monsanto Ortho-nitrobiphenyl, contact the nearest Monsanto Sales Office or mail the coupon.

Send for new catalog on Monsanto Intermediates. It contains technical information on more than a half-hundred important chemicals, including ortho-nitrobiphenyl. Mail the coupon for your free copy.

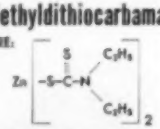
Research Chemists' Corner

You may find something new here

The three Monsanto chemicals described here are worth exploring for possibilities in developing and improving products . . . in replacing all or part of scarce materials. If you'd like to experiment with them, mail the coupon for samples which will be supplied to you without cost or obligation.

Zinc diethyldithiocarbamate

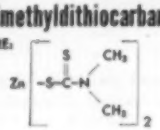
STRUCTURE:



APPEARANCE: White powder.
SPECIFIC GRAVITY: 1.44 at 25° C.
MELTING POINT: 173° C. min.
FINENESS: 99.5% min. thru 200-mesh.
SOLUBILITY: Soluble in dilute caustic, carbon disulfide, benzene and chloroform.
HEAT LOSS: 0.5% max.

Zinc dimethyldithiocarbamate

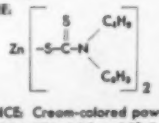
STRUCTURE:



APPEARANCE: White powder.
SPECIFIC GRAVITY: 1.66 at 25° C.
MELTING POINT: 248° C. min.
FINENESS: 99.5% min. thru 200-mesh.
SOLUBILITY: Soluble in dilute caustic, carbon disulfide, benzene and chloroform.
HEAT LOSS: 0.5% max.

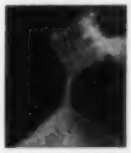
Zinc dibutyldithiocarbamate

STRUCTURE:



APPEARANCE: Cream-colored powder.
SPECIFIC GRAVITY: 1.25 at 25° C.
MELTING POINT: 102° C. min.
FINENESS: 99.5% thru 200-mesh.
SOLUBILITY: Soluble in carbon disulfide, benzene, chloroform and gasoline.
HEAT LOSS: 0.5% max.

Send for booklet giving technical data on 30 chemicals that offer possibilities for further research. The coupon is for your convenience.



Dust in dry detergent compounds is controlled by the addition of a small amount of Sterox CD.

Sudsing is controlled by Sterox CD, a 100%-active detergent, surface-active agent and emulsifier.

If you don't want dust... if you don't want suds... use Monsanto Sterox CD

Sterox* CD is a liquid, nonionic, 100%-active detergent, surface-active agent and emulsifier. It is compatible with cationic and anionic detergents and with soaps. It is efficient in a wide range of applications, including metal cleaning, metal treating, textile scouring and wetting, and in numerous other processes requiring cleaning, wetting out or emulsification.

Sterox CD blends readily with soap, carbonates, silicates, phosphates and all synthetic detergents. It gives outstanding performance in hot or cold, hard or soft water.

For technical information, mail the coupon for a free copy of Technical Bulletin No. P-129.

STEROX CD DATA (typical values)

Appearance	Pale-yellow to light-amber liquid
Odor	Mild fatty odor
Sp. Gr. at 25° C.	1.060
Viscosity	
Saybolt Furol Seconds:	
at 70° F.	250
at 100° F.	100
at 210° F.	20
Pour Point	50° F.
Flash Point	518° F.
Hygroscopicity	Slightly hydroscopic

SOLUBILITY—Miscible in acetone, benzene, carbon tetrachloride, ethanol, xylene. Partly soluble in ether (ethyl), gasoline, kerosene, methanol and mineral spirits.

URGENT... return containers promptly

There's an acute shortage of tank cars, carboys and drums. These containers are urgently needed for the transportation of chemicals from our plants to yours.

If you buy in tank-car quantities, please unload cars as quickly as possible and start them back to Monsanto.

If you buy in carboys or returnable drums, completely empty one drum or carboy before starting on another, and send the empties back. You'll help yourself to better service by returning drums, carboys and tank cars just as soon as you can. The shipment you hold up may be your own.

Santomerse No. 1... detergent useful in numerous industries

Versatility makes Monsanto Santomerse* No. 1 the all-purpose detergent and wetting agent. It serves many industries in numerous applications from laying dust on race tracks to dehairing hogs.

Among the various uses of Santomerse No. 1 are cleaning, penetration, dispersion, emulsifying and spreading. It is so effective that many industries that require two or more of these functions use Santomerse No. 1 for all of them. This simplifies their inventories.

Santomerse No. 1 is an anionic detergent-wetting agent with a minimum of 40% active alkyl aryl sulfonate, the remainder being principally sodium sulfate builder. This combination has been found best for high efficiency and economy.

Free-flowing Santomerse No. 1 is compatible with other detergents and builders. It is effective in hard or soft water, in acid or alkaline baths, in hot or cold solutions. In operations where pH is important, Santomerse No. 1 is ideal because it does not affect the pH to any marked degree. Any change that does take place can be adjusted easily.

If you use a detergent or wetting agent in your business, you'll find interesting and helpful information in Monsanto's booklet, "*Santomerse No. 1 All-purpose wetting agent and detergent.*" Indicate your wishes on the coupon and a copy will be mailed to you free. If you want suggestions on the use of Santomerse No. 1 in specific applications, contact the nearest Monsanto Sales Office.

NEW... Santomerse 80

Santomerse 80 is *new* in the extensive line of Monsanto's synthetic detergents. It is 80% active alkyl aryl sulfonate, the remainder being principally sodium sulfate builders. Generally, it can be used in place of Santomerse No. 1 to get less bulking. Santomerse 80, available in flakes, blends easily with phosphates, carbonates and silicates. Mail the coupon for details.

New safety for die casters by maker of Skydrol

Photographed in the plant of the Dallin Corporation.

With Pydraul* F-9, Monsanto brings new safety to die-casting in the same degree that Skydrol* fire-resistant-type hydraulic fluid has brought new safety to aircraft operations. Skydrol now is serving all domestic air lines flying DC-6's.

Pydraul F-9 is a nonflammable-type hydraulic fluid proved under test conditions far more severe than those encountered in normal die-casting operations. For example:

Pydraul F-9 did not flash or ignite when sprayed, dripped or flooded on molten metal heated to approximately 1,500° F.

Pydraul F-9 did not flash or ignite when sprayed, at 1,000 p.s.i., into the 6,000° F. zone of an oxyacetylene welding flame.

Pydraul F-9 has been proved in service for more than two years. In addition to *safety*, it offers *economy* and *efficiency*. Pydraul F-9 is highly resistant to mechanical shear and chemical breakdown. It is an excellent lubricant that is noncorrosive to metals ordinarily used in hydraulic machines.

If you are interested in a hydraulic fluid that offers extra safety and efficiency, mail the coupon for Monsanto Technical Bulletin No. O-75.

Orthophenylphenol, Technical, Available

Here's a useful organic chemical that you can buy . . . now . . . from Monsanto . . . at a reasonable price.

It is orthophenylphenol, technical, which is employed as an intermediate or raw material for the manufacture of a variety of products, among them: preservative for glues and paints, germicide for poultry and stock disinfectants.

Typical Analysis of Orthophenylphenol, Technical

Crystallizing Point	50.6° C.
Appearance: Solid	Lt. Tan-White
% Ortho P. P. (from Cryst. Pt. Curve)	95.2
Phenol (from Cryst. Pt. Curve)	4.8
First Drop	277° C.
50%	288° C.
Dry Point	289° C.

MONSANTO CHEMICAL COMPANY, 1700 South Second Street, St. Louis 4, Missouri. District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

*Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY... WHICH SERVES MANKIND

SEND INFORMATION: ☐ Ortho-nitrobiphenyl. ☐ Orthophenylphenol. ☐ Santomerse 80.

SEND LITERATURE: ☐ Intermediates catalog. ☐ Booklet, "Santomerse No. 1." ☐ Sterox CD Bulletin P-129. ☐ Pydraul F-9 Bulletin O-75.

SEND SAMPLES: ☐ Zinc diethyldithiocarbamate. ☐ Zinc dimethyldithiocarbamate. ☐ Zinc dibutyldithiocarbamate.

MONSANTO CHEMICAL COMPANY
1700 South Second Street, St. Louis 4, Missouri

Please send, without cost or obligation, information, literature or samples indicated at the left.

Name.....Title.....

Company.....

Street.....

City.....Zone....State.....

UNLOADING TIME:

FAST UNLOADING of sand and rock resulted in big savings in man-hours and demurrage costs for a large contracting firm when they installed this Allis-Chalmers car shaker.

Carloads of sand pumped from a river are completely unloaded in three runs, each of ½ to ¾ minute duration. Cars of 1 x 6 in. crushed stone are unloaded at this plant in less than one minute!

Owners are pleased, too, with the car shaker's sturdy construction. The body is a one-piece, all-welded structure made of reinforced steel plate and stress-relieved to eliminate welding strains. Totally enclosed motor inside shaker body is cradled in specially designed rubber mountings to protect it from vibration.

Chances are, you can save money in your operations with an Allis-Chalmers car shaker. Call the A-C representative in your area for more facts. Allis-Chalmers, Milwaukee 1, Wisconsin.

Car Shakers Promote Safety to Personnel!

ALLIS-CHALMERS

Allis-Chalmers Mfg. Co.
Milwaukee 1, Wis.

Please send my copy of Car Shaker Bulletin 07B7221A.

Name

Title

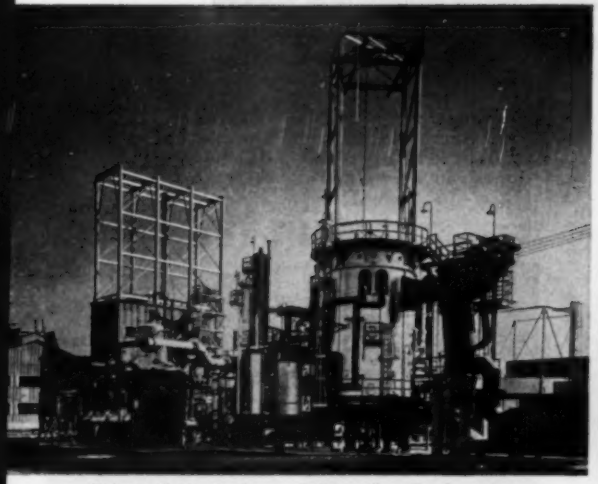
Firm

Address

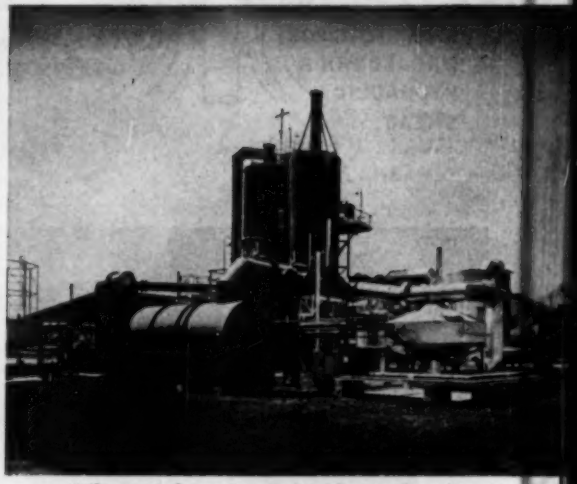
City State A-3395

New Fertilizer Plant in MEXICO now in operation

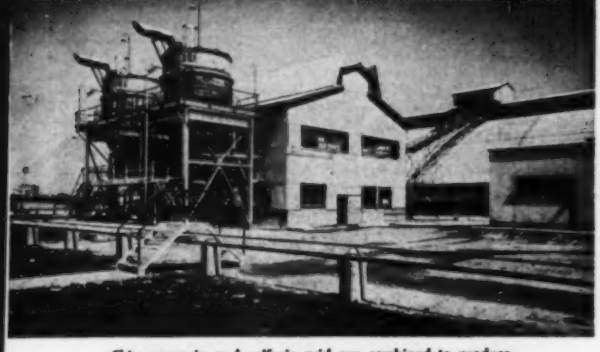
COMPLETED BY CHEMICO



Hydrogen from natural gas and nitrogen from the air are combined in proper proportions under pressure to form ammonia.



Sulfur, removed as an impurity from the natural gas, becomes the raw material for the manufacture of sulfuric acid.



This ammonia and sulfuric acid are combined to produce 70,000 tons of ammonium sulfate per year.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

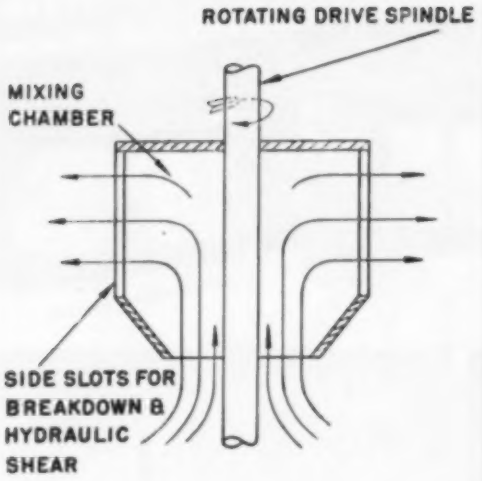
EUROPEAN TECHNICAL REPRESENTATIVE:
CYANAMID PRODUCTS, LTD., LONDON W. C. 2, ENGLAND
EUROPEAN LICENSEE OF N. E. C. PROCESS:
HYDRO-NITRO S. A., 9 QUAI DU CHEVAL BLANC, GENEVA, SWITZERLAND
CABLES: CHEMOCONST, NEW YORK

Chemico Plants are Profitable Investments

OC 510

NEW DISCOVERY

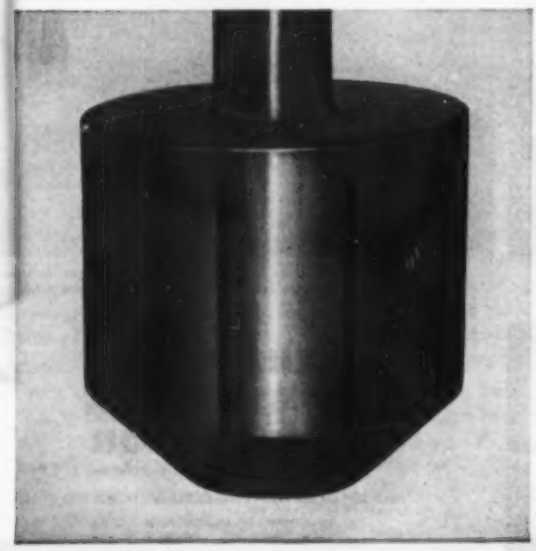
Premier Simplex Dispersators



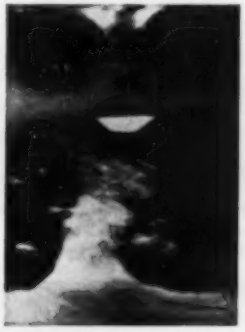
The SIMPLEX DISPERSATOR is a slotted cylinder rotating at high speed. The centrifugal force resulting from this high-speed rotation forces the products through the slots under considerable pressure. A double shearing effect is thus obtained. The product is sheared at high speed as it passes through the slots; the columns of liquid emerging from the slots are further sheared as they make contact with the relatively slower-moving mass of liquid outside the cylinder.

MIXES IN FRACTION OF TIME REQUIRED BY PROPELLERS

Suppose you want a liquid/solid reaction to produce a gelatinous product. Normally, each solid particle becomes coated with a gelatinous layer. Until this insulating layer is removed, the reaction cannot be completed. Propellers remove the layer very gradually. The SIMPLEX DISPERSATOR shears off the gelatinous insulation from the solid particles almost immediately, with little or no slowing down of reaction time. Thus a process which may take hours or days with a propeller mixer can be completed in minutes or even seconds with a SIMPLEX DISPERSATOR.



VISUAL PROOF



(Above) Shows DISPERSATOR running at comparatively low speed, sucking up a heavy organic liquid and producing a finely divided dispersion, which is shown being thrown off the sides of the DISPERSATOR itself.

(Right) The two liquids are ortho nitro toluene and water. Speed of DISPERSATOR is low to show its action. Suction column of O.N.T. is shown entering the bottom of the DISPERSATOR and leaving in a dispersed state. If DISPERSATOR reaches its proper speed (3,000-4,000 r.p.m.'s) all of the O.N.T. would be dispersed in the form of an emulsion within a few seconds.

PREMIER MILL CORPORATION

2180 GENESEE STREET • GENEVA, NEW YORK

IN MIXING *Amazing Speed Lower Cost*

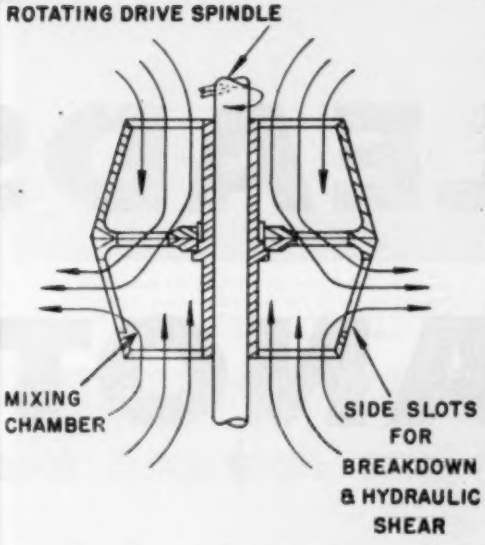
Premier Duplex Dispersators

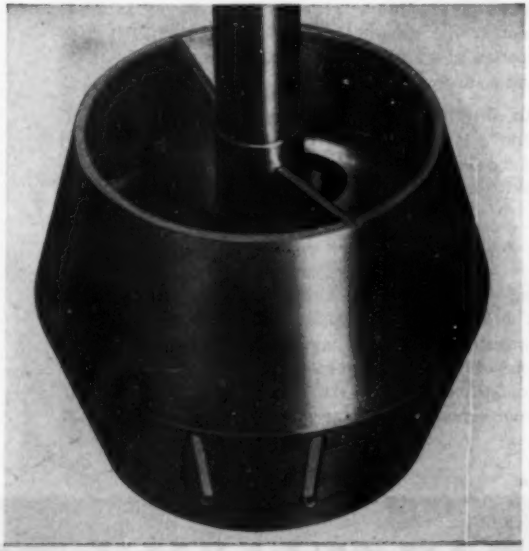
While the SIMPLEX DISPERSATOR is perfectly adequate for some uses, there are many processes where a more thorough and faster breakdown and wetting of materials is necessary. In these cases the DUPLEX DISPERSATOR is recommended.

Whereas the SIMPLEX DISPERSATOR has a single-flow direction, the DUPLEX DISPERSATOR permits *two-way* flow, by virtue of a double cone construction which forces liquids to enter the rotating cylinder from both top and bottom. This *two-way* flow forces intense mixing and wetting action in the lower cone before liquids escape through wall slots.

Thus the DUPLEX DISPERSATOR may be used effectively to mix or blend two liquids of different specific gravity. It is ideal for drawing heavy solids from the bottom and light materials from the surface to insure thorough wetting and dispersion.

The DUPLEX DISPERSATOR, due to its double-flow action, will mix fluids of greater viscosity than the single-cone SIMPLEX DISPERSATOR. This is an important function in the blending of color pastes and in promoting chemical reactions in mixtures which become highly viscous as the reaction is completed.





ASK OUR ENGINEERS

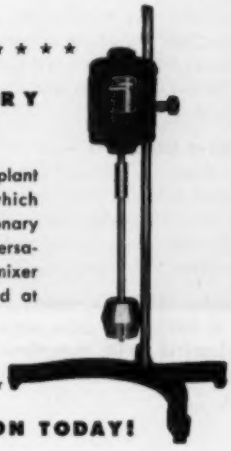
If you have processes where mixing, dispersing, or reacting time is excessive, tell your problem to our engineers. If you give full details, our engineers can help you by recommending the right model and size DISPERSATOR to solve your problem.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

LABORATORY MIXER

Laboratory or pilot plant model available, which shows the revolutionary features of these Dispersators. You can try this mixer on a small scale and at low cost.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★



MAIL THIS COUPON TODAY!

PREMIER MILL CORP.
2180 Genesee Street, Geneva, N. Y.

Send me full details of the SIMPLEX DISPERSATOR and the DUPLEX DISPERSATOR.

Name .....

Firm .....

Street and Number .....

City ..... State .....

ONE VU LEADS TO ANOTHER

When VU Boilers were first put on the market, *all* of them, quite naturally, had to be *sold*. Now a very substantial percentage are *bought*. Bought by companies that know by their own first-hand experience what they can expect in day-in and day-out performance—for example:

A paper company some years ago, in urgent need of more capacity, purchased a VU Unit. It went on the line, and—under wartime demand—*stayed there* for 432 days without a shutdown. What do you think they bought when next in the market in 1946? That's right . . . another VU (much bigger than the first).

An automobile company installed its first VU Units (2) in 1947. Two more were ordered for another of its plants in 1948; then three more units for a third plant in 1949 and two more for still another plant in 1950.

A refinery ordered its first VU Unit in 1937. In 1941 another was installed and still another in 1950. For another of its plants two units were ordered in 1942 and a third in 1947.

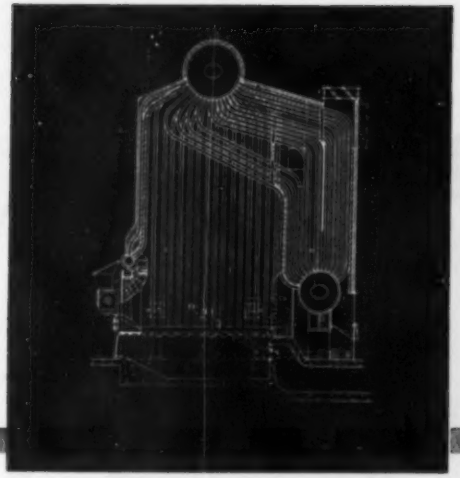
An electric utility company installed its first VU Unit in 1941. Two more units were ordered for another of its plants in 1947, a unit for a third plant in 1946 and still another for a fourth station in 1949.

* * *

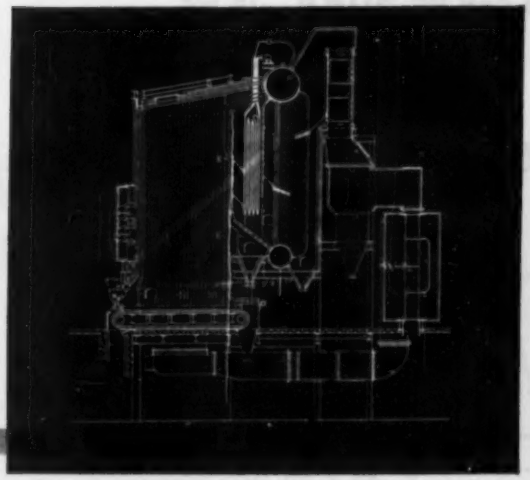
And so it goes — in all sections of the country — and abroad — industry after industry ordering and *reordering* VU Boilers. There must be a reason—and there is. The VU's advanced design, rugged construction and consistent reliability have become a service-proved answer to lower steam costs. You can choose VU with confidence based on the experience of companies in *your* industry, in *your* area. B-485

COMBUSTION ENGINEERING

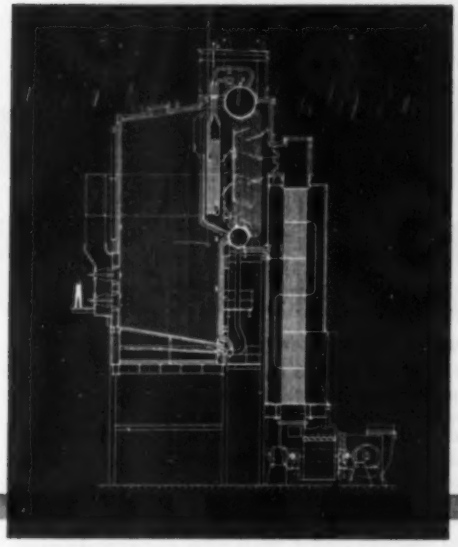
ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS. ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



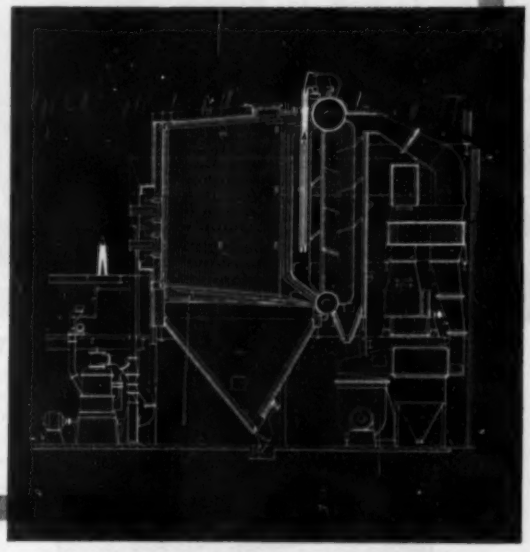
VU-10 Unit fired with C-E Spreader Stoker (dumping grate type). VU-10 Boilers range in capacity from 10,000 to 60,000 lb of steam per hr. May also be fired by underfeed or traveling grate stokers, or by oil or gas.



VU-50 Unit fired with C-E Spreader Stoker (continuous discharge type); auxiliary gas and oil burners in upper front wall. Capacity of unit shown is 90,000 lb steam per hr; operating pressure—630 psi; steam temperature—825F.



VU-50 Unit fired with natural gas or oil. Design provides for future pulverized coal firing. Capacity of unit shown is 350,000 lb of steam per hr; operating press.—920 psi; steam temp.—905F.



VU-50 Unit fired with pulverized coal using C-E Raymond Bowl Mills. The capacity of unit shown is 150,000 lb of steam per hr; operating pressure—600 psi; steam temperature—700F.

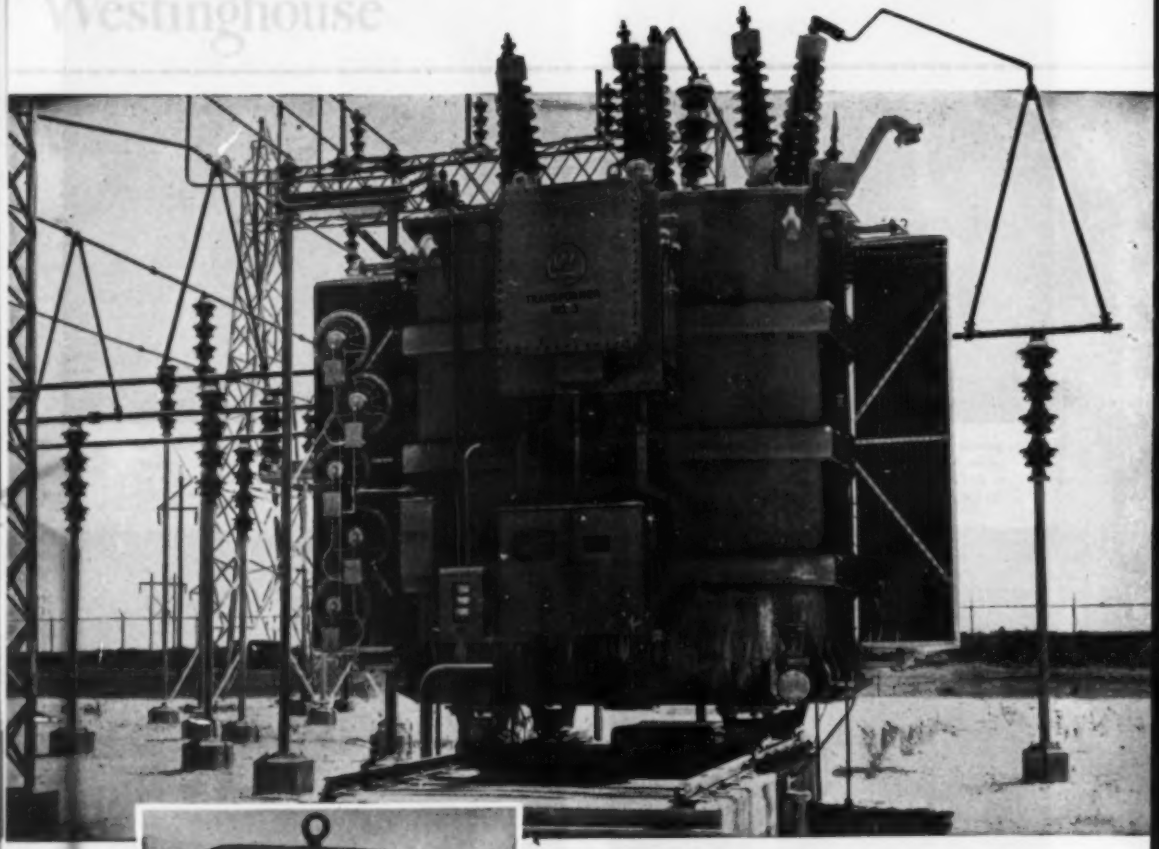
— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



This power transformer

in a chemical plant is an example of the corrosion-resistant equipment designed by Westinghouse for the Chemical Industry. To resist weather and corrosive conditions, all transformer tanks are Bonderized. All-welded construction assures positive protection against leaks, moisture or corrosive fumes.

The corrosion-resistance

of the specially coated, heavy steel, Life-Line chemical motor is shown by the results of this extended salt spray test. Shown here are a cast-iron chemical motor (above) and the Life-Line chemical motor (below) after operating for several months in a 20% salt spray. At the end of this time, the Life-Line motor continued to operate while the cast-iron motor had failed. An examination of both motors showed considerably less corrosion on the Life-Line motor.

We help you fight corrosion

To help the Chemical Industry combat corrosion, Westinghouse has developed an extensive line of corrosion-resistant electrical equipment. We use three ways to make this equipment resist the corrosion that may exist in your chemical plant:

Selecting Metals. For each kind of equipment, we choose the metal or alloy suitable for the application that will best resist corrosion. For example, nonferrous alloys are used liberally in making Type E turbines, Type V outdoor disconnecting switches and Ignitron rectifiers. Specially coated, heavy gauge steel is used on our Life-Line chemical motors.

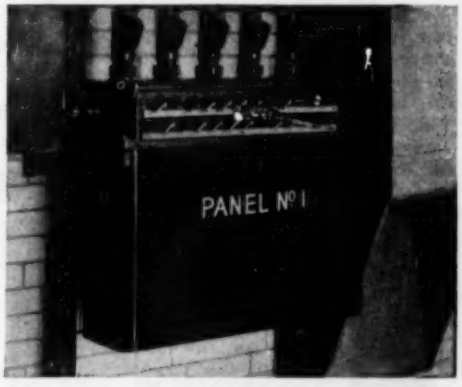
Oil Immersion. To give absolute protection against both corrosive and hazardous atmospheres, we make a wide variety of oil-immersed equipment. This includes oil-immersed power transformers, panelboards, circuit breakers, linestarters and pushbuttons.

Protective Coatings. To prevent corrosion from creeping back under the paint film when a scratch occurs, we Bonderize the enclosures of Westinghouse switchgear, transformers and control equipment. To further protect our outdoor switchgear from corrosion, we also give it an all-weather undersurface coating.

Westinghouse has Chemical Industry Specialists who will gladly help you with the solution of the electrical problems in your chemical plant.

Call your nearest Westinghouse District Office, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-94805



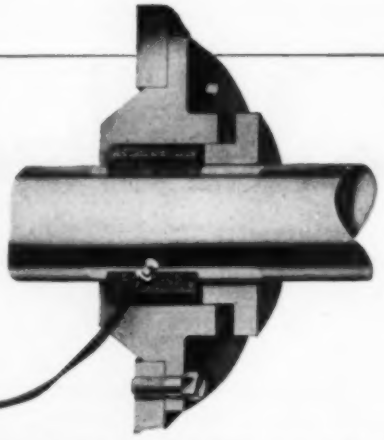
In this oil-immersed, nofuze "De-ion" breaker panelboard, each breaker is completely submerged in oil and operated by an external handle through a gland-type bushing. This provides a corrosion-resistant and explosion-proof panelboard.

Westinghouse

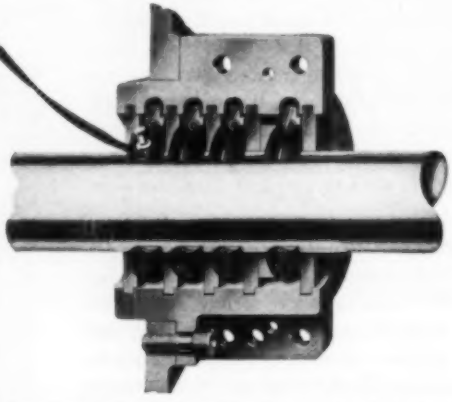
EQUIPMENT FOR THE CHEMICAL INDUSTRY

COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .

WRITE FOR BULLETIN 135
COPPUS ENGINEERING CORPORATION
226 Park Avenue
Worcester 2, Mass.
Sales offices in THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

Now...get better results from poor fuels!

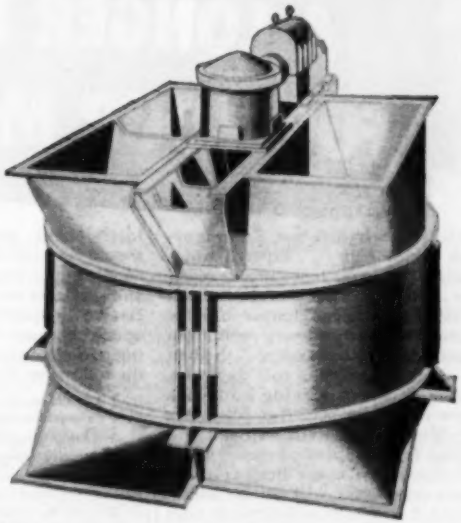
The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

Problems presented by today's available fuels hold fewer complications in those boiler plants equipped with Ljungstrom Air Preheaters.

High temperature combustion air is the key factor to efficient combustion of low-grade fuels, especially coals with high ash or moisture content. With the Ljungstrom Air Preheater it is possible to obtain higher preheat more economically.

In addition, the *continuous regenerative counterflow principle* of the Ljungstrom permits reliable operation at low exit gas temperature. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.

If you are planning a new installation, or modernizing your present one, our engineers will welcome the opportunity to show you how the Ljungstrom can enable you to get better results from low-grade, less costly fuels.



THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

A LONGER RUN FOR YOUR MONEY!

Rex Idlers are built to last. Triple labyrinth grease seal . . . tapered roller bearings . . . extra large grease reservoir . . . these are a few of the Rex advantages that mean longer life for idlers, belts and machinery parts. Even if just one idler "freezes up," the belt can wear through the roll shell in a matter of hours, leaving knife-like edges to cut the belt. Rex Idlers are fully greased at the factory and will operate for long periods even without minimum maintenance. But Rex Idlers, or any other make, will give far longer service if minimum maintenance rules are followed. The fact that many Rex Idlers are still going strong after more than 25 years of service is, we believe, proof of the pudding.

Idlers, belts and machinery parts should be inspected periodically, depending upon amount of use. Greasing and servicing should be done as indicated by inspection. (Normally, 1000 operating hours is the average greasing period). Inspection should include the following checks:

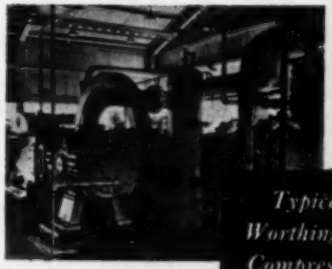
1 **All rolls turning freely and smoothly, with no excessive bearing end play.**
2 **All rolls properly seated in brackets.**
3 **No unusual damage to rolls, brackets or base.**
4 **Evidence of adequate greasing at seals but no excessive amount. Don't overgrease.**
5 **Check for accumulation of material under rolls. Keep deck plates clean.**
6 **No buildup of material on return rolls.**
7 **Grease pipes and fittings in good usable condition. No broken pipes or missing fittings.**
8 **Belt running true and self-aligning idlers operating freely.**

You'll find it pays to follow these tips. For more detailed information on idler care, approved idler greases, and for all the facts on the complete Chain Belt Idler line, send for Bulletin 463-R. **Chain Belt Company, 1648 West Bruce Street, Milwaukee 4, Wis.**

CHAIN BELT REX COMPANY

BELT CONVEYOR IDLERS

If it's a gas that can be handled ...WORTHINGTON COMPRESSORS *Handle it Better!*

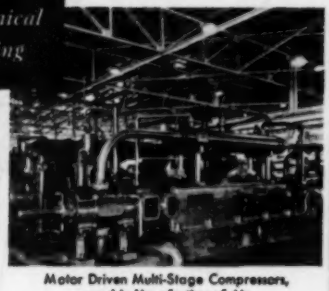


Steam Driven Compressors in a Synthetic Glycerine Plant.

Steam Driven High Pressure Circulators in a Nitrogen Fixation Plant.

Typical Worthington Compressor-Installations For Chemical Processing

Angle Gas Engine Driven Compressors in a Gas Oxidation Plant.



Motor Driven Multi-Stage Compressors, used in Liquefaction of Air.

Keeping pace with the chemical industries' rapid progress, Worthington builds compressors for the widest range of gases. More than that, Worthington maintains a staff of specialists whose sole job is to know — or to find out — the answers to all problems concerning gas compression.

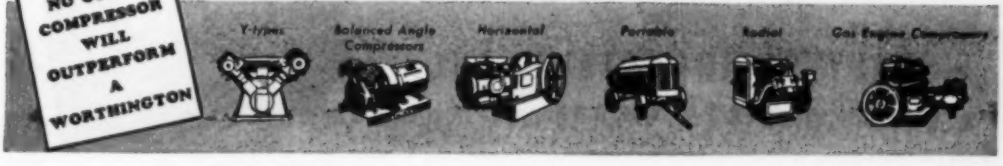
That is why your own applications in this field can be best served by Worthington . . . with compressors that will perform more efficiently and economically over a longer service life. Why not get the whole story that proves *there's more worth in Worthington*? Write, describing your requirements, to *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.*

Partial List Of Gases Handled By Worthington Compressors

Butane • Propane • Butadiene • Carbon Monoxide • Carbon Dioxide • Acetone Benzole Mixture Sulphur Hexafluoride • Coke Oven Gas • Ethylene • Ethylene Dichloride • Furfural • Hydrogen Hydrogen Chloride • Hydrogen Sulphide • Methyl Chloride • Methyl Ethyl Ketone • Nitrous Oxide Oxygen • Sulphur Dioxide • Vinyl Chloride • Ethylene Oxide

WORTHINGTON

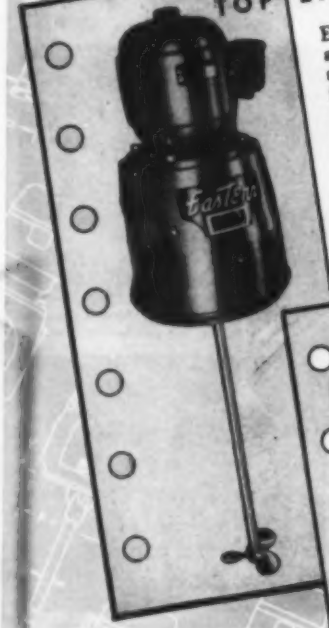
NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

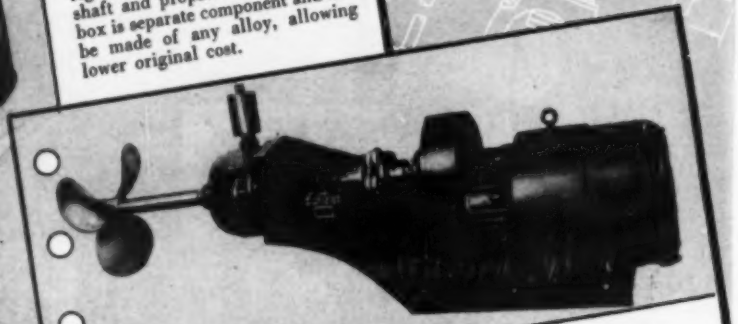


..EQUIPMENT NOTES

TOP ENTERING MIXERS

Eastern Series C Vertical Mixers are applicable to a wide variety of specialized needs. They're designed for tanks needing agitators with a range of 1/4 to 10 H.P. at standard speeds of 1725, 1140, 420 and 280 R.P.M. They have standard NEMA ball-bearing type motor with a rigid-type coupling between motor shaft and propeller shaft. Stuffing box is separate component and can be made of any alloy, allowing lower original cost.

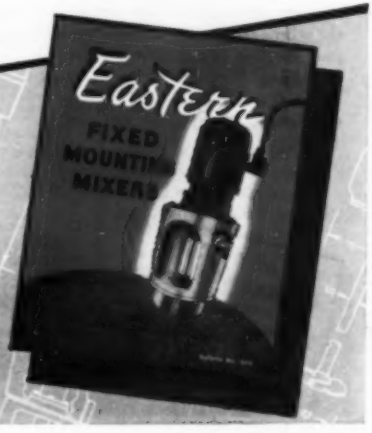




HEAVY-DUTY SIDE ENTERING MIXERS

Eastern Series A Mixers are extra heavy-duty machines for large tank capacity. They range from 5—30 H.P. at standard speeds of 1150, 420, and 280 R.P.M. Shaft is coupled to standard motor by flexible coupling, and the shaft and bearing housing move as single unit to allow easy adjustment and repair. Stuffing box is repackable with full tank.

Eastern



Catalog sent on request...

The complete Eastern catalog of Fixed Mounting Mixers, both Top and Side Entering, is yours on request. Ask for Bulletin TB-600.

EASTERN INDUSTRIES, INC.

• • • NORWALK, CONN. • • •

Naugatuck

ROYAL FAMILY OF PLASTICS

Naugatuck Marvinol lifts the lid on your plastic future

There is a good deal more than ice cubes in this unusual bucket made of Marvinol vinyl resin.

If you look into it, chances are you'll find a whole "bucketful" of promising ideas for *your* product future.

Look what Marvinol did for this product! In the new cellular form, this "n'Icer"* Bucket is "finger-lift" *light* . . . so *flexible* it can squeeze apart clustered ice cubes . . . so *insulating* that the ice cubes are 90% themselves after four hours! It won't *tarnish*—is *unbreakable*, is *lovely* to look at and can be made in all colors—a perfect compliment to any table. It *imparts no odor or taste*.

As you read about Marvinol-made ice buckets, perhaps you can visualize what Marvinol may do to *improve your* products. Marvinol can create hundreds of things—film, sheeting, sponging, or rigid—better and more economically.

And in Naugatuck Chemical, you have a reliable, *basic* source of raw materials that's in business to stay. Write us on your company letterhead today.

**Made by The Sponge Rubber Products Company, Shelton, Connecticut.*

Naugatuck Chemical **Division of UNITED STATES RUBBER COMPANY**

206 ELM ST., NAUGATUCK, CONNECTICUT

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • New York • Philadelphia • **In Canada:** Naugatuck Chemicals, Elmira, Ontario

MARVINOL vinyl resins • KRALASTIC styrene copolymers • VIBRIN polyester resins

WORLD'S FIRST COMPLETELY LITHOGRAPHED AND INNER ROLLER-COATED 55-GALLON STEEL DRUM

Rheem R

BIG CONTAINERS NOW "TRAVELING BILLBOARDS"

Consider the merchandising opportunities this remarkable new package presents! The durable and lustrous finish of Rheemcote drums, lithographed with *your* distinctive colors, trademarks and designs, will billboard your product and name before the eyes of the world.

SAFE AS A DRINKING GLASS

For products which are hard to contain, or those requiring an absolutely clean interior—special lacquers are applied to the prepared interior surface, then cured in a temperature-controlled oven.

ROLLER-COATING OPERATION...

applies the base coat to the steel surface, assuring positive adhesion for utmost resistance against weather and handling.

NEW ELECTRIC "RESISTANCE" WELDING PROCESS...

for the body of the drum gives an unusually clean, smooth seam—without any possibility of burn-off metal fragments.

After many years of research, the Rheem Manufacturing Company, world's largest maker of steel shipping containers, is proud to have developed the Rheemcote Process in this, its 25th year of service to industry.

For a *free*, descriptive, beautifully illustrated brochure on this important contribution to marketing—write or wire Rheem today.

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Plants and Affiliates Throughout The World

Rely on Rheem to Deliver Your Goods..and Goodwill

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We Mobilize for Freedom

WHY Controls are Necessary

One of the encouraging characteristics of the American people is their dislike for government controls. This augurs well for the future of their economic and political freedom.

But for the next few years we must not only tolerate but also help to make effective a whole battery of emergency government controls over our economic life. If we fail to do this now the future of that freedom we cherish will be imperilled. It is the purpose of this editorial—the third in a special series—to explain in simple terms why this is so.

After our military victory in World War II, we rushed through a demobilization which cut our military strength to about one-tenth of its wartime peak. Our allies did much the same thing. But the Russians maintained much of their wartime military strength and built up that of their satellites. With prodigious speed we switched from military to civilian production and went on to enjoy a rousing postwar boom—the greatest in our history.

This boom was in vigorous progress when, on June 25 last year, the Russian-sponsored North Korean army attacked South Korea. Our industrial production was rolling along at almost twice its prewar level. We had labor shortages in many key industrial areas. Under the impact of heavy buying all along the line, prices were climbing.

When the North Koreans smashed into South Korea they smashed into our national consciousness this fact: if we want a fair chance to save our national freedom from destruction by Communist aggression, we must race to restore some of the military power we had so speedily written off after World War II. And we must do it with our resources already very fully occupied with a boom in civilian business.

Program Small Compared to World War II

Compared with our military effort in World War II, the mobilization on which we are now embarked is small. At its peak, under present schedules, it will absorb no more than one-fifth of the total national production. During World War II we reached a point when nearly half of our total production went for war-making.

Moreover, our economy now is much bigger and stronger than it was in World War II. During the last decade there has been an increase of about 15 percent in our labor force. Our workers have had the training advantage of steady employment. The capacity of our industrial establishment is two-thirds again as great as it was ten years ago. Since the war no less than $70 billion has been spent to expand and modernize it.

Given time, the industrial giant we have created could pick up in its stride the added load of production for defense that now is con-

templated. But speed is of the very essence. There is little dissent from the proposition that if we are to stand off Russian aggression successfully we have, at the outside, two years in which to get ready.

Controls Needed to Prevent Chaos

These two facts – (1) the necessity for speed in our rearmament program and (2) an economy already stretched taut by a record civilian boom—create the general necessity for government controls. If we simply pile the billions of added defense expenditures authorized since last June on top of the civilian boom, and let it go at that, two destructive developments would follow. There would be a scramble for scarce materials, notably metals, which would create chaos in those markets. And prices would go through the roof.

Our situation during this mobilization is radically different from what it was when we rushed to get ready for World War II. Then we started with an economy that was coming out of a long depression. There was plenty of slack. Even in mid-1941 we still had over 6 million unemployed. Thus it was possible for us to expand war production greatly and also increase civilian living standards before the limits of our productive capacity made extensive controls necessary. But as we begin this new mobilization we find our economy already operating virtually at capacity. This fact is of key importance in understanding why this relatively small defense program so quickly requires the imposition of controls.

The selection and administration of controls thus far has been badly bungled. The threat of price controls, for example, was broadcast so vigorously and for so long that our people were virtually asked to raise prices and thereby do much to defeat the controls. Adequate taxation directed so as to attack inflation at the source and thus give direct price control a chance to operate has not yet been provided.

Indeed, we could readily assemble a long and devastating catalog of the deficiencies of the government's control program. But that would not dispose of the necessity for controls – by priority, by allocation, and, as a stop-gap, by direct prescription of selling prices – if we are to carry out our mobilization successfully. That is the only means by which a clear right of way for defense production can be cut through the highways of trade and commerce now jammed with civilian boom business.

Hope In The Wilson Plan

Since he became Director of Mobilization, Charles E. Wilson has added a new element of order and hopefulness to the mobilization program. He has laid out a plan which, if we are spared all-out war, would do three things by 1953. First, it would produce the weapons needed by our army and our allies to meet an immediate threat. Second, it would create the capacity that would enable us to move at high speed into weapons production for all-out war – if necessary. Third, it would create the additional production capacity that would restore by that date our ability to resume the climb of the American civilian standard of living.

In technical and industrial terms the Wilson Plan seems to be feasible. If it is successfully carried out, we should be able to begin getting rid of controls rapidly by 1953. But to carry out the program successfully, it must now have vigorous support from everyone. That does not mean mere agreement that it is a good plan. It means that we must conform to the controls that are necessary to make the plan work. In developing this support, the business community is in position to exercise crucially important leadership.

As has often happened in our national history, we are confronted by a paradox. We must accept emergency controls for the time being to insure survival of the freedom that they infringe. But, as we do this, we may find some comfort in the reflection that while controls from Washington are hateful, controls from Moscow would be infinitely worse.

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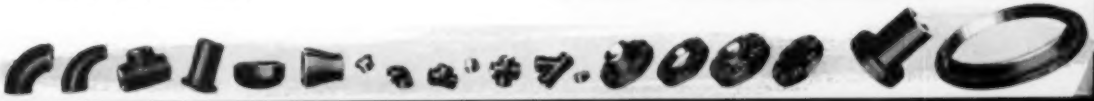

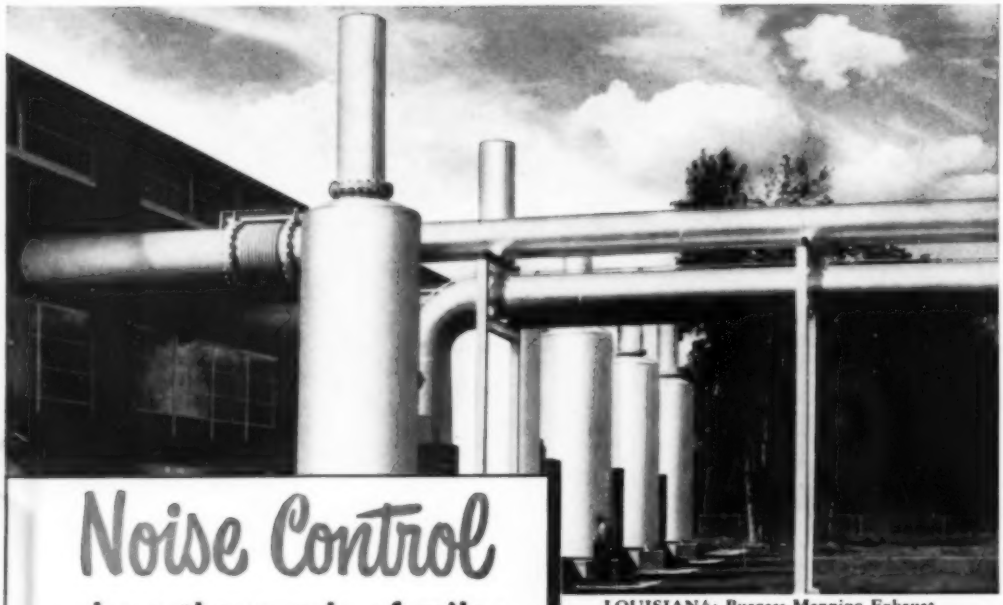

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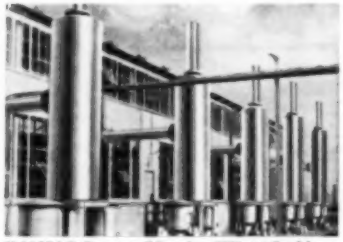

KANSAS: Burgess-Manning STL-14 Snubbers on 800-hp engine compressors.

LOUISIANA: Burgess-Manning Exhaust Snubbers installed on Cooper-Bessemer engines.

TEXAS: Burgess-Manning Snubbers on eight 1100-hp gas engines.

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Celanese protects its petrochems with Tri-Sure Closures

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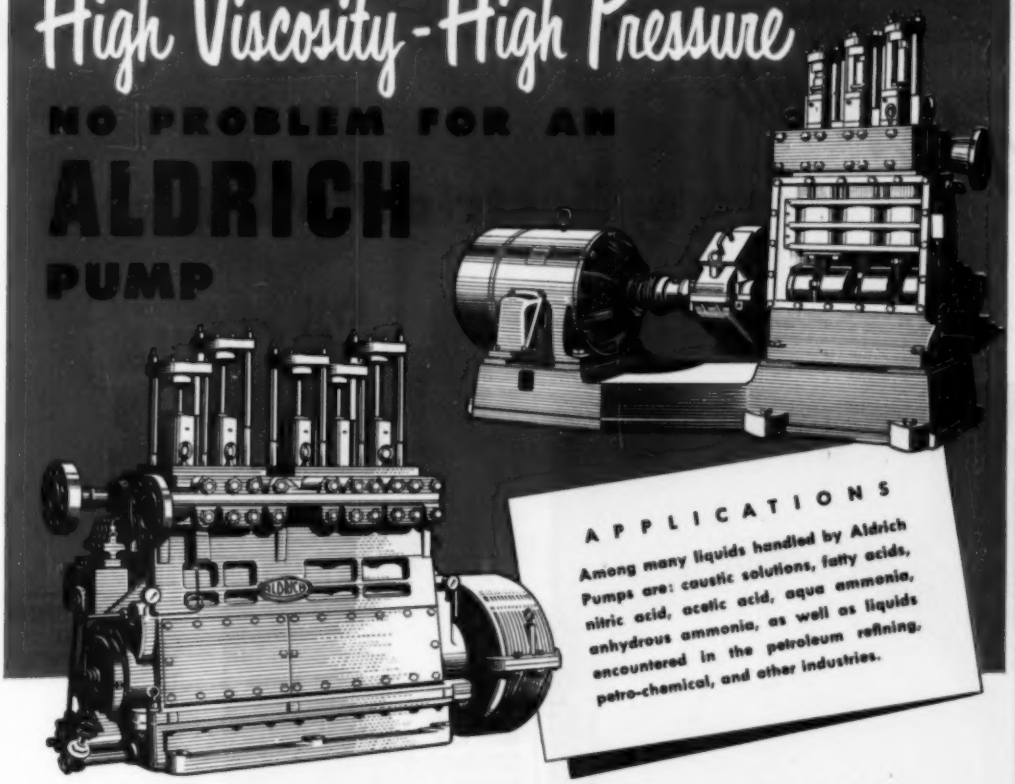

APPLICATIONS

Among many liquids handled by Aldrich Pumps are: caustic solutions, fatty acids, nitric acid, acetic acid, aqua ammonia, anhydrous ammonia, as well as liquids encountered in the petroleum refining, petro-chemical, and other industries.

Aldrich Direct Flow Triplex and Quintuplex Pumps

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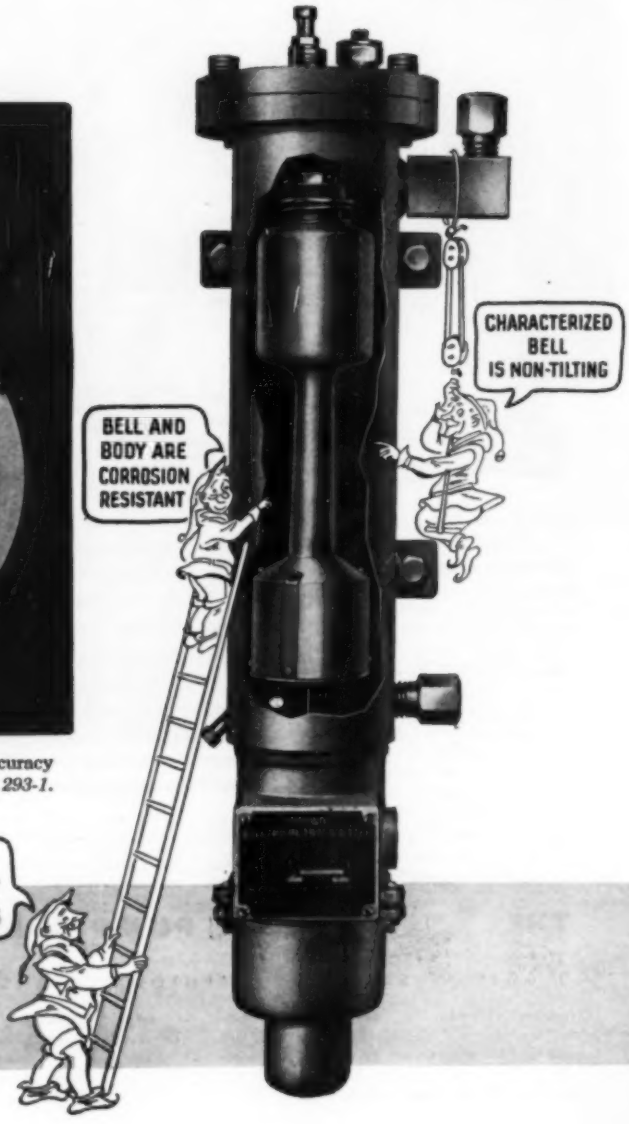

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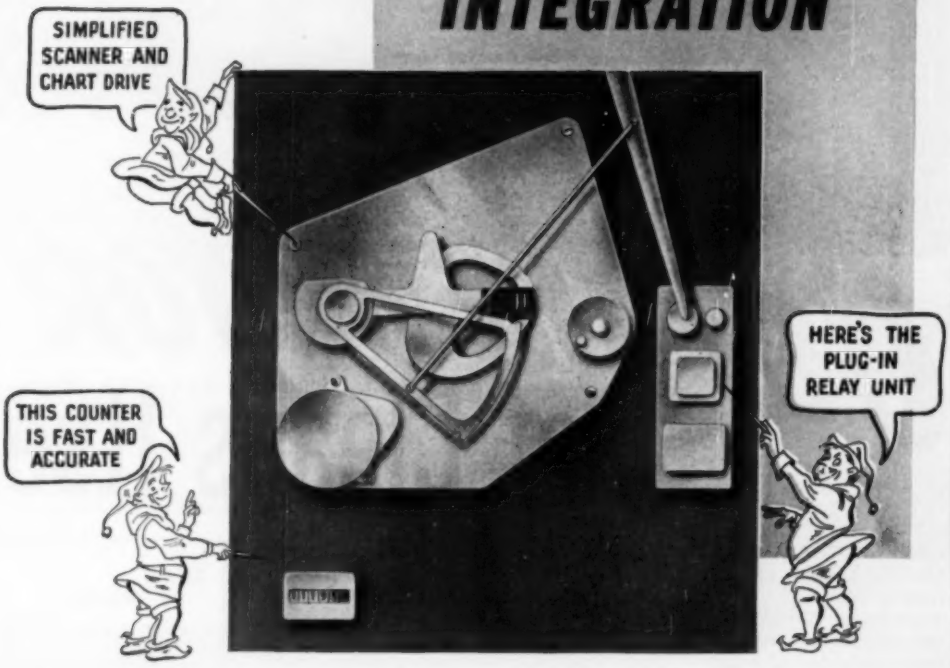

HERE's another important advancement for power and process instrumentation . . . continuous flow measurement, with electronic integration! This Honeywell development eliminates intermittent measurement and slow, complicated totalizing . . . welcome news to process engineers and accountants.

The electronic integrator, consisting of but three major parts, simplifies accessibility and maintenance . . . permits quick checking and calibration. Scanning is rapid and extremely simple. The corrosion resistant meter body is of tubular construction, reducing weight and bulk. Transmission is electric, recorder is fast, chart is easily read under all conditions of flow. The characterized bell is corrosion resistant, too, and is specially designed to eliminate tilting.

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Here's Why

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The frame is of rigid cast iron which not only has high inherent corrosion resistance, but also holds bearings in alignment. Bearings are prelubricated at the factory and should need no attention for years. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are standard equipment.

Get All The Facts

The new Allis-Chalmers Type APZ totally-enclosed fan-cooled chemical motor is built in all NEMA standard frame sizes from 224* to 505. Also in explosion-proof type.

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Look What's Happened

RESULT...

Fast-drying, durable finishes that provide up to double the final film thickness with a single "pass" of the spray gun. Often, one coat of hot lacquer gives adequate coverage.

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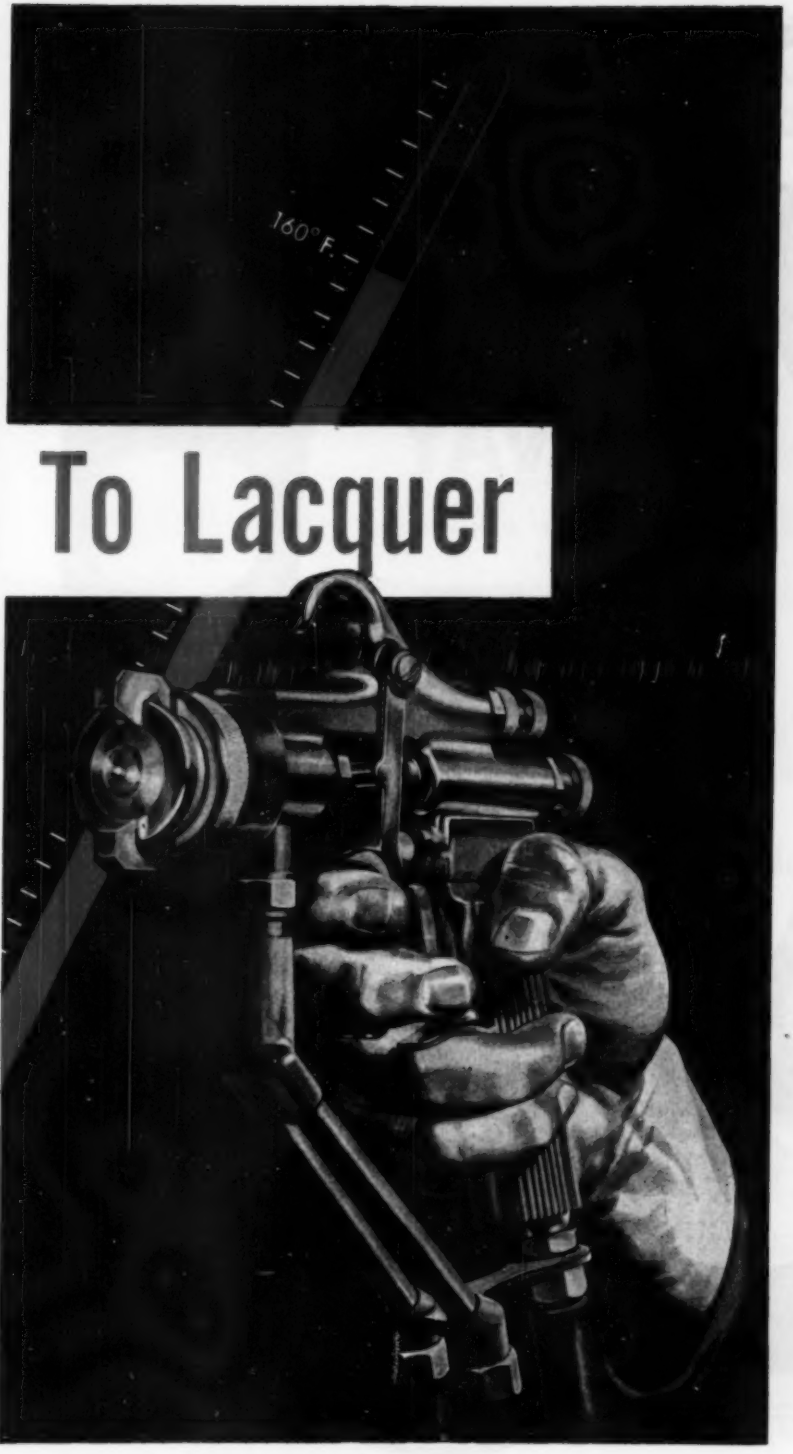

To Lacquer

Please Return Drums

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Thank you for your cooperation.

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B-48 is recommended for low foaming alkaline formulations used in dish washing, bottle washing, metal cleaning, and automatic home laundry compounds. It is also recommended for use as an emulsifying agent in the preparation of emulsifiable concentrates and emulsions. Send for free testing sample.

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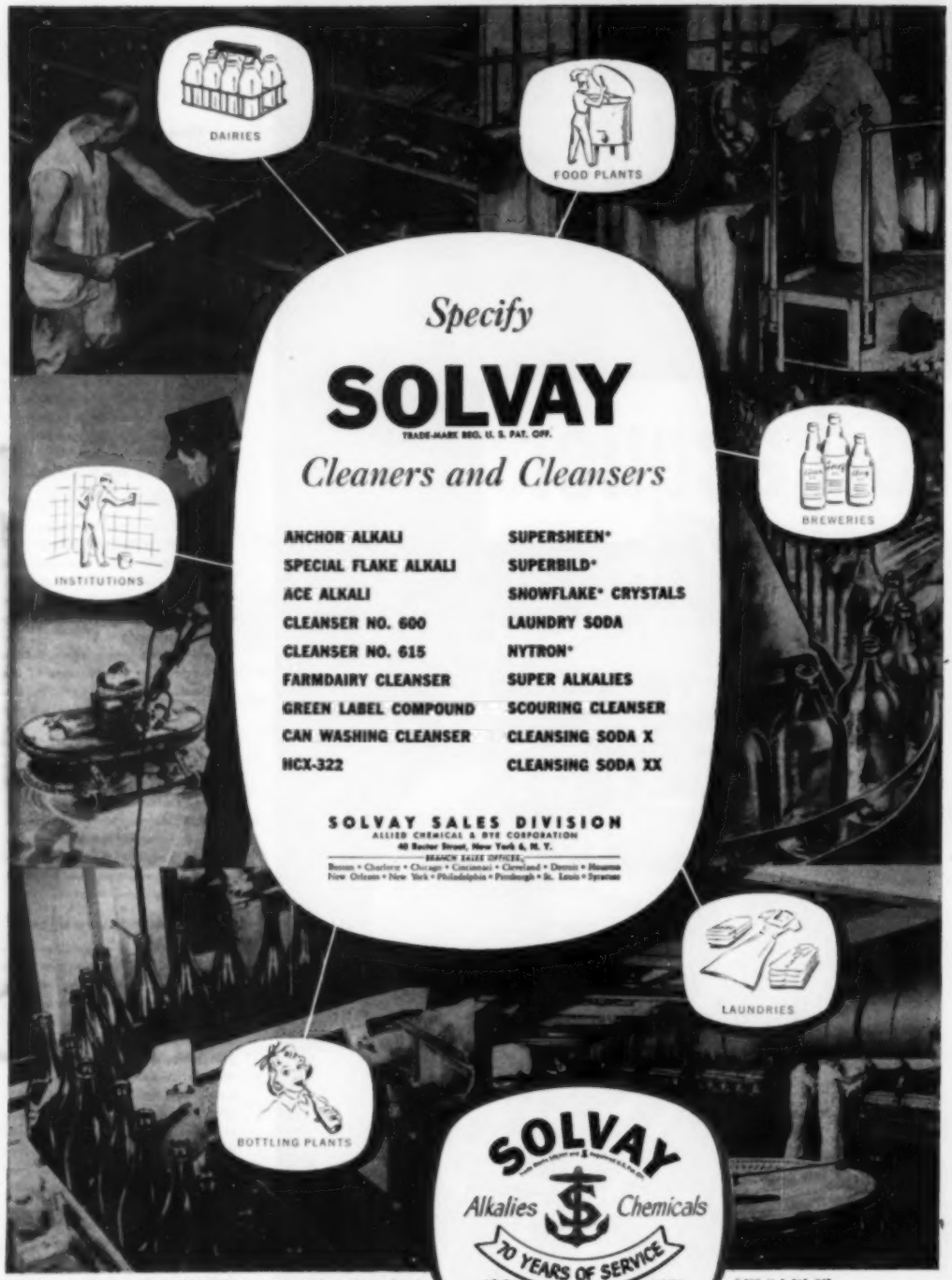

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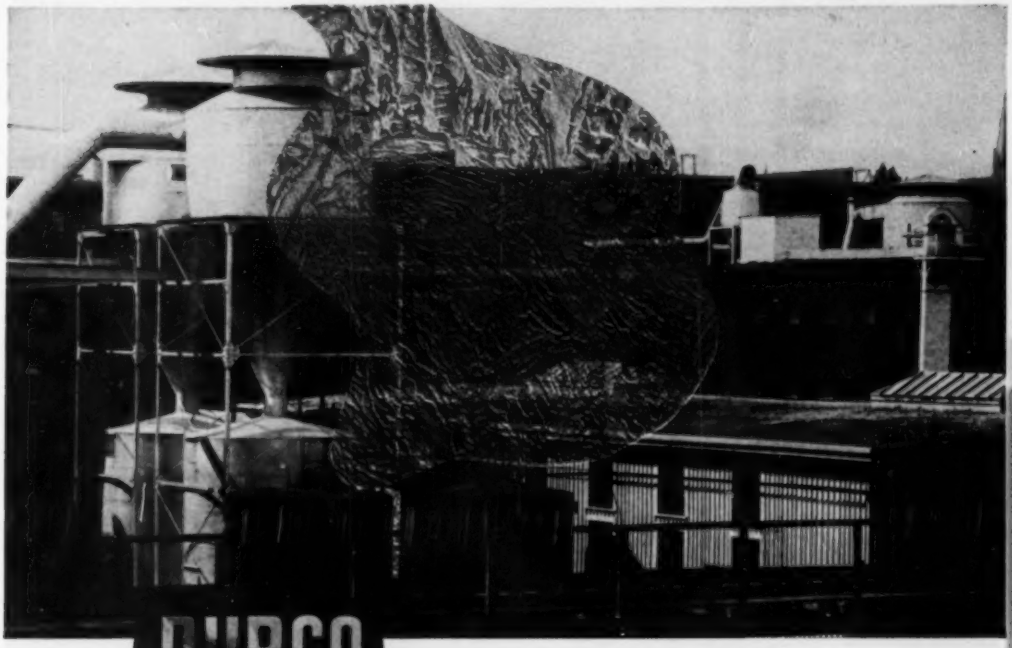

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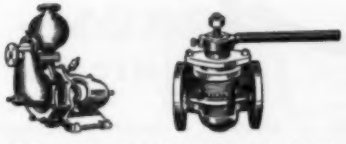

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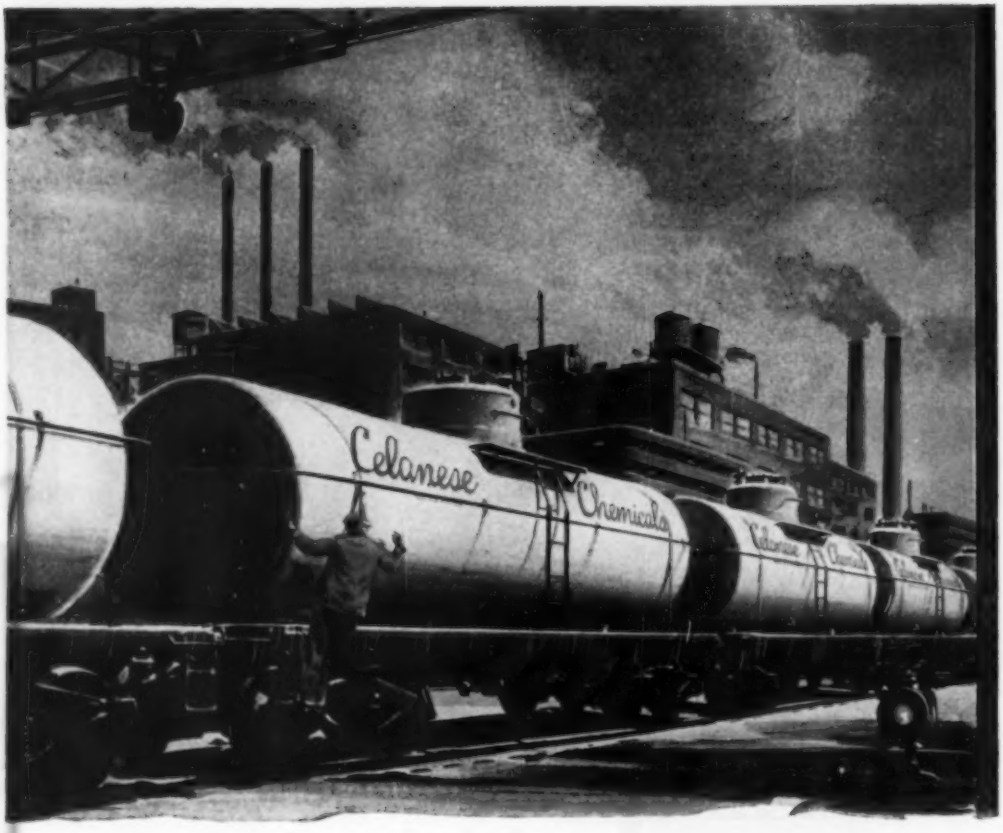

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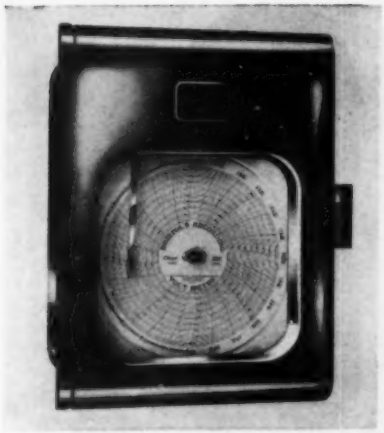

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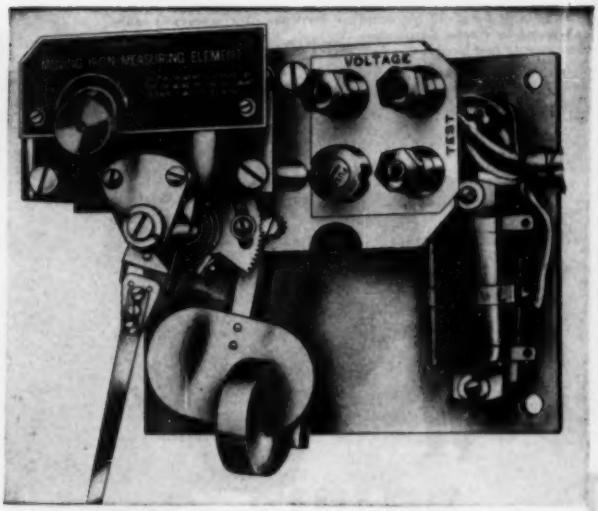

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Processors who obtain equipment made from U·S·S Stainless Steel can be confident that they are getting a perfected, service-tested material—one that will give them the finest possible performance. Make equipment of U·S·S Stainless Steel a part of your future planning.

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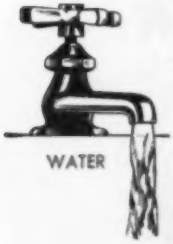
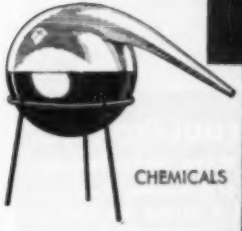


WATER



CHEMICALS

PROVED–
by low upkeep cost records
in every type of service

JENKINS BUILDS *EXTRA VALUE* INTO VALVES

— yet, despite this extra value, you pay no more for Jenkins Valves. For new installations . . . for all replacements, let the Jenkins Diamond be your guide to lasting valve economy.
Jenkins Bros., 100 Park Ave., New York 17.
Jenkins Bros., Ltd., Montreal.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

MASTROL SYSTEM for Forced Hot Water Heating
MASTER CONTROL
SUB-MASTER REGULATOR
PNEUMATIC CONTROLS
No. 11 Self-Operating Regulators
PNEUMATIC CONTROLS
Thermostat
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Packless Valves Available
3-Way FLOWRITE Valve
FLOWRITE Diaphragm Valve
Pneumatic Switches
AIRSTREAM Thermostat
POWERSTROKE
Damper Motor
ACCRITEM REGULATOR
Compressed Air or Water Operated
FLOWRITE Valve
METAFLOW Valve
Available Packless
POWERS
TEMPERATURE and HUMIDITY CONTROL
For Heating and Air Conditioning Systems Industrial Processes
Water Heaters • Heat Exchangers Jacket Water Cooling
All Types of Baths Hospital Hydrotherapy
Most of your control problems can be solved sucessfully with the aid of a POWERS engineer and the proper application of some of our modern products. Why not profit from our 60 years of experience? There's no obligation. Phone or write our nearest office.
Series 100 Pneumatic Indicating Regulator
Pneumatic
Right: Static Pressure Regulator
Left: Series 100 Recording Regulator
Self-Operating
Thermostatic Water Mixers
THE POWERS REGULATOR CO.
Established 1891 • Offices in Over 50 Cities • See Your Phone Book
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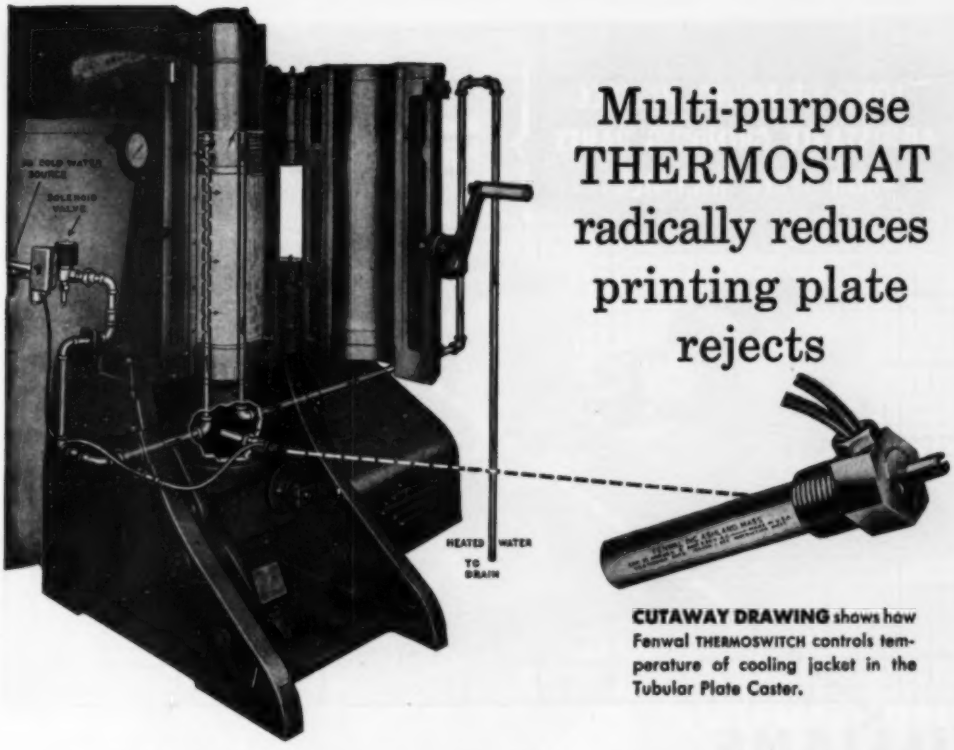
TORONTO, ONTARIO • 195 Spadina Avenue
MEXICO, D. F. • Edificio "La National" 601



Multi-purpose THERMOSTAT radically reduces printing plate rejects

CUTAWAY DRAWING shows how Fenwal THERMOSWITCH controls temperature of cooling jacket in the Tubular Plate Caster.

The Tubular Plate Caster machine used in the production of printing plates at the Nordmann Printing Company, 4210 Chippewa St., St. Louis was the seat of considerable trouble when it was water cooled by a hand valve. If too much cold water was run into the cooling jacket, the temperature was reduced so fast that the plates shrank. If too little water entered, the temperature remained too hot and plates became porous. In either case, plates had to be remelted and recast with resultant loss of labor and time.

The problem was solved by replacing the hand valve with a solenoid water valve and installing a low-cost Fenwal THERMOSWITCH thermostat. This unit opens the valve when water gets too hot. Cold water then flows in, hot water drains off, and valve is shut when proper water temperature is reached. *As a result, rejects have been practically eliminated.*

This is but one of many ways in which easy-to-install, easy-to-maintain Fenwal THERMOSWITCH Units effectively control variables where heat is a factor. Their unique principle of operation consists of an activating control element that is a single-metal shell. This shell expands or contracts *instantaneously* with temperature changes, making or breaking the totally enclosed electrical contacts.

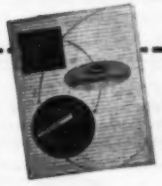
Fenwal THERMOSWITCH thermostats can no doubt help you in your own processing. Find out how by mailing the coupon today.

Fenwal

THERMOSWITCH

The Precision, Multi-Purpose, Thermostat Control

SENSITIVE . . . but only to heat



FREE! Get this bulletin . . . see what Fenwal THERMOSWITCH units can do for you. *Just fill in coupon and mail . . . no obligation.*

FENWAL, INCORPORATED, 166 Pleasant St., Ashland, Mass. 111 South Burlington Ave., Los Angeles 4, Cal.

TEMPERATURE CONTROL ENGINEERS

Name ..... Position .....

Company .....

Street .....

City ..... Zone ..... State .....

I am chiefly interested in the applications checked:

☐ Heating ☐ Cooling ☐ Humidity Control or Detection

☐ Alarm (over-temperature, under-temperature) ☐ Vapor Control

☐ Timing (thermal) ☐ Radiant Heat Control

☐ Pressure Control (by controlling vapor temperature)

OTHER (Please fill in your special requirements) .....

.....

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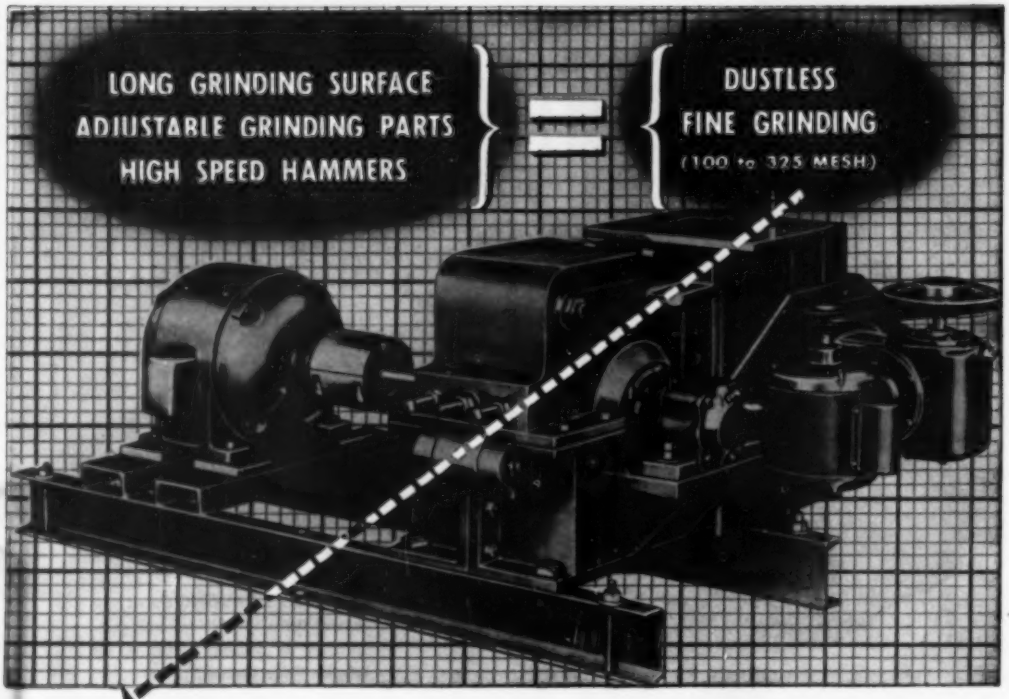
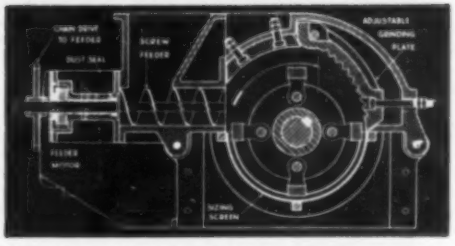


WILLIAMS
HELIX-SEAL HAMMERMILL

NO FANS, CYCLONES OR SEPARATORS. Material fed into screw feeder is discharged at bottom of mill completely pulverized . . . with no oversizes or tailings to be separated. Screw feeder also acts as a seal against inrush of air. No dust! Williams' Helix Mill grinds many materials to 325 mesh. 100 to 200 mesh products are common on more difficult materials. Yes! It'll grind wet and sticky materials, too! Variable speed control permits grinding of different kinds of materials. **EASY, INEXPENSIVE TO INSTALL AND OPERATE!** Small floor space and lack of vibration calls for simplest of installation. Only requirement is a tight bin below mill with some sort of outlet. All parts are easily cleaned . . . on most materials simply by brushing. Feeder drive consists of roller chain drive from fractional horsepower gear head motor to feeder screws.

WILLIAMS PATENT CRUSHER & PULVERIZER CO.
2706 N. NINTH STREET ST. LOUIS 6, MO.



Sectional view of Helix-Seal Mill. Note long grinding plate against which the material is ground before it reaches the sizing screen. This plate is adjustable to compensate for wear.

WILLIAMS ALSO MAKES . . .

Heavy-duty hammermills; impact and roller mills for 200 to 325 mesh grinding; drier mills; air separators; vibrating screens; steel bins; complete "packaged" crushing and grinding plants.

WC48-7

WILLIAMS

CRUSHERS GRINDERS SHREDDERS

Positive Roll Adjustment Gives You UNIFORM Chemical Granulation!

ALLIS-CHALMERS

Roller Mill

RECOMMENDED FOR NUMEROUS CHEMICAL FIELD APPLICATIONS

Ammonium Nitrate	Mineral Phosphate
Sodium Sulphate	Plaster
Calcium	Pumice
Diatomaceous	Potassium Nitrate
Casein	Sodium Sulphate
Coal	Resin
Sodium Oxalate	Rubber Waste
Iron Powder	Silica Gel
Lignin	Sodium Silicate
Magnesium	Soda Ash
Oil Cake	Sodium Nitrate
Phosphate	Synthetic Zeolite
Clay	Zinc Salt

AND MANY SIMILAR PRODUCTS

- HEAVY DUTY DESIGN AND CONSTRUCTION
- EXTRA LONG LIFE "CIRCLE-CHILL" ROLLS
- CLOSE, POSITIVE ROLL ADJUSTMENT
- STRAIGHT-LINE WELDED STEEL BASE
- POWER SAVING "TEXROPE" DRIVE

HERE'S A POWER-SAVING MILL that's designed to turn out chemical products consistently *uniform* in size—and built to stand the gaff of constant day-in-and-day-out usage.

Note the outstanding features of this efficient machine—listed at left. Note, too, the numerous chemical materials successfully processed on this Allis-Chalmers Style N roller mill. Chemical men from coast to coast are using this mill for the uniform granulation they *want and need* in their plants.

There's a size and type for every requirement—with 9 and 10 inch diameter rolls, 24 to 42 inch roll lengths, and one, two or three-high pairs of rolls. You pick the unit best suited for your particular application.

Get the full story from your nearest A-C sales office or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3334

Texrope and Circle-Chill are Allis-Chalmers trademarks.

ALLIS-CHALMERS

CHEMICAL MILLING AND PROCESSING EQUIPMENT

A digester being radiographed with two-million-volt X-ray equipment
QUALITY
BY THE TON
... process equipment by
B&W

Today, fabricating capacity and mechanical design facilities alone cannot provide an adequate solution to the equipment problems imposed by modern processing temperatures, pressures, and stepped-up cycles of operation.

Design and construction of vessels and heat-transfer equipment necessarily involve such relatively new research data as creep characteristics and the metallurgy and methods of welding dissimilar metals and alloys. B&W is particularly well equipped . . . both by research and experience . . . for the proper selection of materials, their fabrication, and integrated assembly to meet the special requirements of modern chemical, petroleum, and food processing.

No matter how "big" you buy, you can still think in terms of *quality* — fine engineering, conscientious craftsmanship, experience, and the ultimate in critical inspection — when B&W contracts for the job. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

Quality material and workmanship are required for high alloys that operate at severely high temperatures

BABCOCK & WILCOX

B-4067

Chemical Progress

News of developments from General Electric's Chemical Department that can be important to *your* business.

Among the new furniture polishes containing G-E silicones is O-Cedar Dri-Glo—described by its manufacturer as being exceptionally long-lasting and easy to apply.

Once again the unique properties of silicones are helping to revolutionize an industry. Furniture polish manufacturers (like O-Cedar Corp'n) find that a properly formulated polish containing G-E silicone oils combines the protective qualities of wax with the easy application features of oils. G-E silicone oils also make furniture polishes more resistant to ultraviolet rays and to water.

Industry already knows how auto polishes have been improved by adding General Electric silicone oils. The new success in the furniture polish field is expected to encourage still other polish makers to improve their products through G-E silicones.

G-E CHEMICAL FACILITIES HELP SPEED DEFENSE PRODUCTION

General Electric chemical products expedite the nation's preparedness program in many ways. G-E chemical plants from Massachusetts to California are turning out such vital defense items as plastics parts, insulating materials, silicone products and protective finishes.

The pistol-grip handle for this searchlight is molded of G-E rubber-phenolic compound. The high internal resilience of this compound reduces breakage during assembly and in actual service. G-E rubber-phenolics have *five times* the shock-resistance of conventional phenolics.

Interested in better polishes? Write for details to Chemical Department, General Electric Company, Pittsfield 13, Massachusetts.

PLASTICS COMPOUNDS • SILICONES • INSULATING MATERIALS • GLYPTAL® ALKYD RESINS • PLASTICS LAMINATING, MOLDING, AND EXTRUDING

You can put your confidence in

GENERAL ELECTRIC

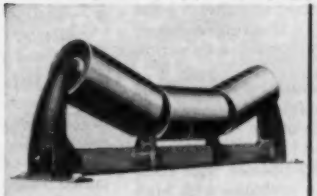
LINK-BELT engineering experience...

Plus

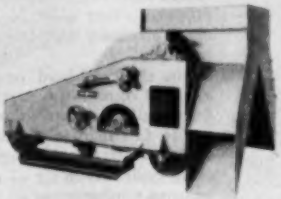
LINK-BELT quality components...

...add up to your best buy in BELT CONVEYORS

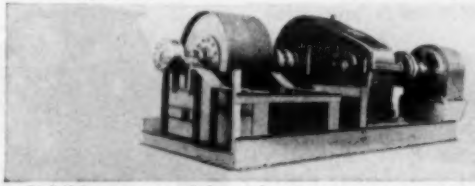
Link-Belt belt conveyor system carries washed phosphate from railroad cars to ground storage, to the drying plant and finally to shipping bins.



Series 100 Idlers are superior quality, with high-grade roller bearings and effective grease-in-dirt-out seal.



Link-Belt makes all types of trippers for discharging materials and distributing them along the conveyor belt.



Link-Belt power transmission equipment meets every conveyor need. Shown here: Link-Belt 300 H.P. fluid coupling drive and D-250 herringbone gear reducer.

YES, you get *both*—practical engineering and quality components—when you call on Link-Belt for belt conveyors! Thousands agree Link-Belt makes the finest belt conveyors on the market today.

Engineering experience? Our conveyor specialists draw on an accumulation of years of materials handling and power transmission experience. They will help you and your consultants get top performance from a modern conveying system.

Quality components? We design every item on a belt conveyor system and build it to the highest standards. We make all types and sizes of idlers, take-ups, pulleys, trippers, bearings, drives and supports. You get the *right* equipment for your exact requirements when you rely on Link-Belt.

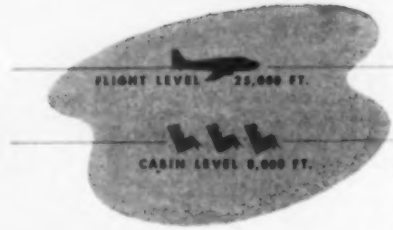
See for yourself! Let us show you some of the modern conveying systems we have installed. See the results of practical Link-Belt engineering experience—simplicity of design, the finest components, and most important, *top performance.*

Remember, there's a Link-Belt conveying specialist in the branch office near you. Call him for complete engineering information.

LINK-BELT

BELT CONVEYOR EQUIPMENT 12,201-A

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities.



In modern air-liners you breathe comfortably at altitudes of 25,000 ft., because your cabin is "Pressurized" — air pressure inside the plane is kept at or near normal sea level pressure.

Boilers, too, "breathe" easier when their combustion air is "pressurized" using forced draft

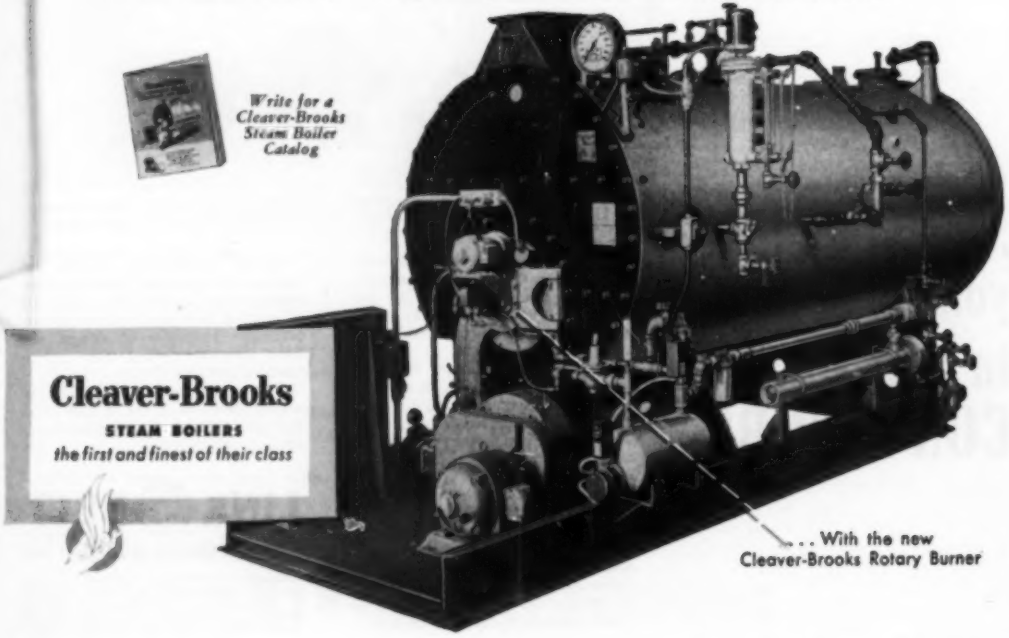
Cleaver-Brooks experience with thousands of steam boilers, of the self-contained type, has conclusively proven these operating advantages of forced draft:

- — because atmospheric boiler-room air is constant in temperature and therefore in density, the weight of air delivered for combustion by a forced draft fan is also constant and always gives proper air-fuel ratio (CO_2) resulting in maximum efficiency and freedom from combustion problems.
- — the electrical load, or power requirement, of a forced draft fan is at a minimum, because the fan handles a lesser volume of air.
- — low fan maintenance and longer fan life with forced draft fans since they operate with cool, clean boiler room air — no problems with high bearing temperatures and corrosion.
- — air is under pressure in the combustion chamber of a forced draft boiler, with no possibility of "diluting" air entering the chamber. Maximum boiler efficiencies are always attained when head plates and casings are tight.
- — lower initial fan cost, better space arrangement, and better appearance are gained because forced draft fans are considerably smaller.
- — casings for forced draft fans are cool — require no insulation — contribute to safer operation and cooler boiler rooms.

Forced draft is one of many reasons why you get a greater return from your investment in a Cleaver-Brooks boiler — a boiler of foremost quality in every detail and with many immediate and long-range cost-saving features. Cleaver-Brooks self-contained boilers are available for oil, gas, combination oil and gas firing — 15 to 500 hp., 15 to 250 lb. p.s.i.

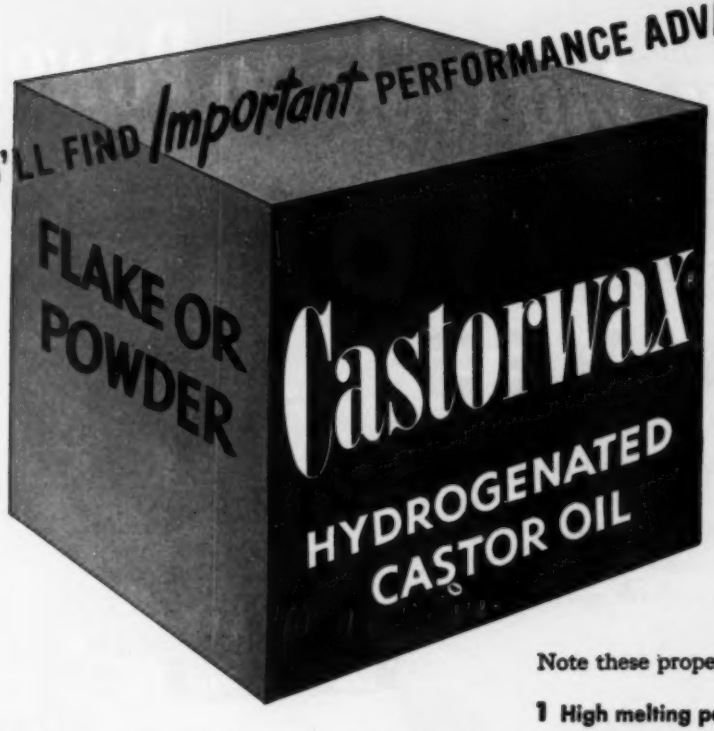
CLEAVER-BROOKS COMPANY
331 E. Keefe Ave., Milwaukee 12, Wis.

Write for a Cleaver-Brooks Steam Boiler Catalog



. . . With the new Cleaver-Brooks Rotary Burner

YOU'LL FIND *Important* PERFORMANCE ADVANTAGES IN



For products involving the use of waxes this synthetic wax offers many advantages.

It differs from tristearin in this important respect: 85% of its fatty acid groups exhibit the hydroxyl group characteristic of castor oil. Investigation of its unique properties will suggest many opportunities for profitable use.

flake Castorwax has proven very useful in hot melts, as a lubricant in drawing or rolling metals, in the manufacture of metallic soaps for greases, in paper coatings, etc.

powder Castorwax is useful in applications where the comminuted form permits dusting or dry impregnation. An outstanding example: Mixed with fine materials to be molded or tableted, in which case it has been found definitely superior to stearic acid or tristearin.

Note these properties:

1. **High melting point, 85-87°C.**
2. **Excellent color, white in the solid form and straw-colored in the molten form.**
3. **Extreme insolubility, in that none of the common organic solvents will dissolve Castorwax.**
4. **High resistance to oils and greases.**
5. **Good hardness with fair gloss.**

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120 Broadway, New York 5, N.Y.

Please send us:

1. Technical Bulletin #7 ☐
2. Property Sheets ☐
3. Sample Powder ☐ Flake ☐

Name.....

Company.....Title.....

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ESTABLISHED 1857

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120 BROADWAY, NEW YORK 5, N. Y.

LOS ANGELES • CHICAGO

Industry looks to Powell

for the latest improvements in

VALVES

That's because Powell never believes in "letting well enough alone," but is continually producing more advanced designs to meet the requirements of modern methods and processes.

Quality line throughout "The Line"

Small size flanged end O. S. & Y. Globe Valve for 150 pounds W.P. Available in various corrosion-resistant metals and alloys, with Stainless Steel bolts and nuts. These valves conform to all latest standards. Also available with screwed ends.

POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

DREW STEARIC ACIDS

FORMULA 200
Stearic Acid (65%)

Hydrogenated, distilled fatty acid equivalent to "double pressed stearic." It has a high titre, low iodine value and color and odor are excellent. Permits manufacturers to obtain a good, light color in the finished product at nominal cost. Widely used in non-ionic emulsifiers, metallic soaps and similar products.

FORMULA 300
Stearic Acid (70%)

Hydrogenated, distilled fatty acid equivalent to general types of "triple pressed stearic." It has exceptional color and odor, high stability and long shelf life. It's a premium grade for use wherever U.S.P., National Formulary and similar specifications must be met. Used as an emulsifying agent for hand lotions, creams, deodorants, brushless shave creams, cleansing creams, cold creams, medicated creams, mascara, etc.

FORMULA 400
Stearic Acid (85-90%)

A special type of stearic acid with exceptionally high titre. It's an all vegetable, hydrogenated, distilled fatty acid with low iodine value and a titre of over 60°C. It is premium grade and used wherever specifications call for higher percentages of stearic acid content than those which are met by Formula 300 or 200.

Other grades of Stearic Acids also available

AVERAGE SPECIFICATIONS

PRODUCT	MYRISTIC (C_{14})	PALMITIC (C_{16})	STEARIC (C_{18})	OLEIC (C_{18})
Formula 200	6.0%	20.0%	70.0%	4.0%
Formula 300	6.0%	21.0%	70.0%	3.0%
Formula 400	6.0%	6.0%	85.0%	3.0%
Formula 1000	6.0%	20.0%	70.0%	4.0%
Formula 1500	6.0%	20.0%	60.0%	14.0%

PRODUCT	FFA	TITRE°C.	IODINE VALUE	ACID VALUE	SAP. VALUE	COLOR 5¼" Lovibond
Formula 200	99-103	56-57	6.0 Max.	196.9-204.8	196.9-204.8	4.0/1.0
Formula 300	99-103	58.0 Min.	4.0 Max.	196.0-204.8	196.9-204.8	4.0/1.0
Formula 400	99.0 Min.	60-64	3.0 Max.	196.9-204.8	196.9-204.8	4.0/1.0
Formula 1000	99.0 Min.	58	6.0 Max.	196.9 Min.	196.9 Min.	35.0/5.0*
Formula 1500	99.0 Min.	54-56	15.0 Max.	196.9 Min.	196.9 Min.	35.0/5.0* *1" Cell

Distilled and Fractionated Fatty Acids

SOYA SAFFLOWER COCONUT LINSEED LAURIC OLEIC COTTONSEED CAPRIC STEARIC CAPRYLIC VEG

Write for reference booklet, "Drew Fatty Acids"

TECHNICAL PRODUCTS DIVISION

E. F. DREW & CO., INC.

15 EAST 26th STREET, NEW YORK 10, N. Y.

CHICAGO PHILADELPHIA BOSTON

DREW PRODUCTS

the *Inside* Story

on Better Pumping Performance

Look at the "insides" of a Fairbanks-Morse Single-Stage Split-Case Centrifugal Pump.

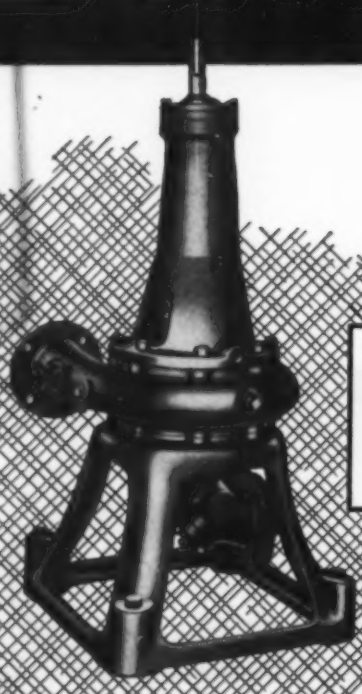
Note how easy it is to inspect or service all working parts . . . the ease with which the entire rotating element can be removed without disturbing driver or pipe connections. It means lower maintenance costs . . . less lost operating time.

Note the sturdy construction and exceptional strength provided by the arched casing and solid pump base . . . the one-piece impeller that reduces wear and maintains efficiency . . . the integrally cast bearing brackets that maintain accurate, permanent alignment of shaft and impeller.

These are but a few of the many performance-making features you'll find that mean more years of efficient, economical service.

FAIRBANKS

A NAME WORTH



. . . and for another "inside" story, look over the amazing new Fairbanks-Morse "Bladeless" Impeller Pump. Here's the ideal pump where your requirements involve the handling of solids. As indicated in the phantom view of the impeller, there are no "blades" to catch or damage pumped material. Food products, for example, can be pumped without damage.

For process handling applications . . . food, chemicals, in fact any application where products are transported in a liquid, the Fairbanks-Morse "Bladeless" Impeller Solids-Handling Pump will pay dividends in lower costs . . . more efficient operation.

don't "Figure" it . . .

READ it to speed weighing . . . stop errors

With Fairbanks-Morse Direct Reading Cabinet Dial Scales, you read the *correct* weight right at the point of the indicator from zero to full capacity *regardless of the number of drop weights used!* This exclusive Fairbanks-Morse development speeds and simplifies weighing . . . minimizes the chance for costly human error.

No mental calculations are required. Drop weights are applied by an easy-acting hand crank. And as the weights are applied, a revolving disc automatically changes the figures on the chart.

You'll find Fairbanks-Morse Direct Reading Cabinet Dials provide the "easy way to weigh" for sustained accuracy and fast operation.

Here's how the Direct Reading Dial eliminates mental calculations. Illustrated above is a small segment of a dial chart. Without drop weight, the figure in the chart window reads 700 pounds. If one drop weight is applied, the figure in the chart window automatically changes to read 1700 pounds.

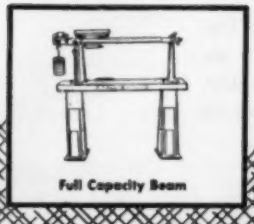
-MORSE

REMEMBERING

See Next Page for FAIRBANKS-MORSE Sales Centers

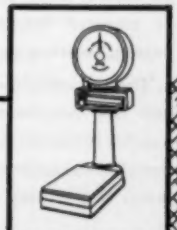
for the ultimate in automatic weighing,

Fairbanks-Morse Direct Reading Cabinet Dials can be equipped with Printomatic Weighers to provide automatic recording of weights on a ticket, roll tape or both. Printomatic recording eliminates the possibility of human error and assures a permanent, accurate record of all weighing operations. In addition to weights, other features such as identifying symbols, time, date, etc., can also be recorded simultaneously. It's the ultimate in fast, accurate weighing.



Full Capacity Beam

Bench Dial Scale



Portable Dial Scale

MOST Advantages for MOST Motor Applications

STANDARD DRIP-PROOF MOTORS FOR YOUR PROTECTION

Practically every motor needs protection—from flying chips, falling particles, dripping liquids, and the like. Also, by far the majority of motors used are of the polyphase, squirrel cage type.

These requirements are met to a unique degree by this series of Fairbanks-Morse motors—with built-in protection and superior electrical and mechanical design that account for their popularity throughout industry.

Whether your motor application problems involve driving pumps, machine tools, compressors, elevators, fans—or any of an infinite number of other applications—Fairbanks-Morse Standard Drip-proof Motors deserve your early investigation. Call your nearest Fairbanks-Morse Sales and Service center.

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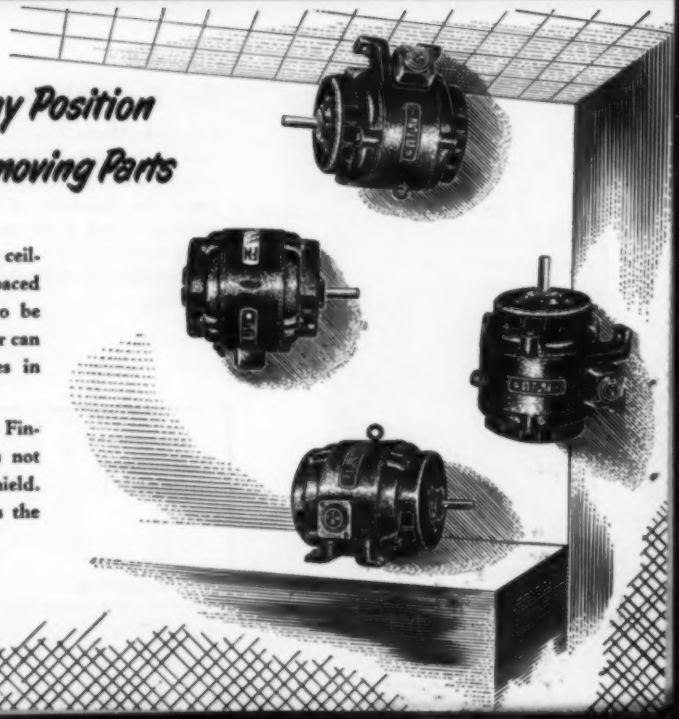
A NAME WORTH

PROTECTION.. *in any Position*
SAFETY.. *no Exposed moving Parts*



Mount these motors anywhere—even on the ceiling or walls. Bearing arms have four bolts spaced 90° apart, enabling the bearing brackets to be adjusted to assure maximum protection. Motor can be mounted vertically without any changes in bearing construction.

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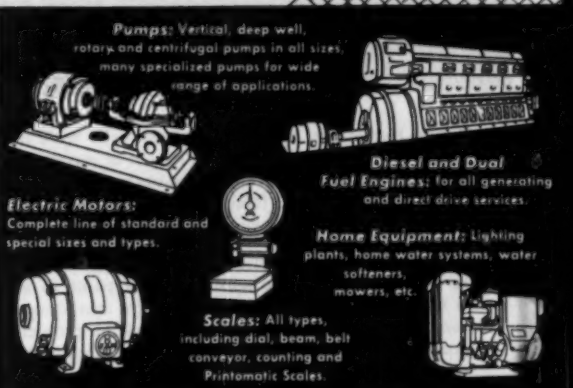
You need all the help you can get these days in procuring new equipment—in obtaining parts and repair service to keep your older equipment running at peak output. You'll find your Fairbanks-Morse Sales Center geared to help you in all these important efforts. It is staffed with factory-trained sales and service personnel, ready to give complete engineering assistance in product maintenance and application.

Unbiased advice is assured, for the Fairbanks-Morse lines of motors, pumps, scales and diesel engines are long and complete: helpful assistance is assured too, for you know you will be dealing with experts in the product in which you are interested.


Pumps: Vertical, deep well, rotary and centrifugal pumps in all sizes; many specialized pumps for wide range of applications.
Diesel and Dual Fuel Engines: for all generating and direct drive services.
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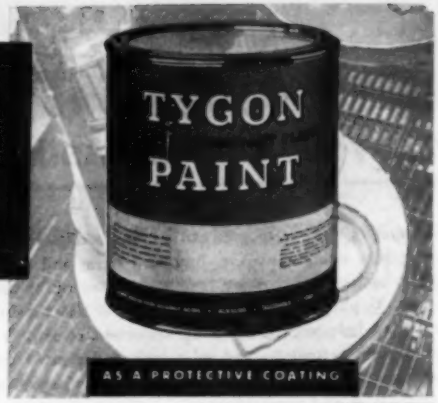
Let TYGON PLASTIC
provide the answer to your TOUGH CORROSION PROBLEMS



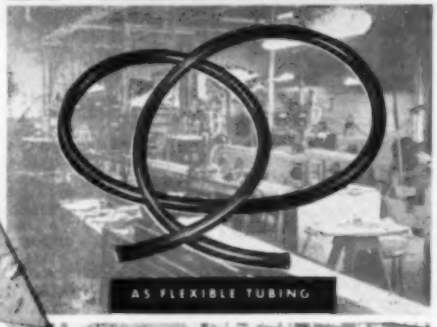
Tygon Plastics are resistant to an unusually wide range of corrosives, much more so than rubber or metals. Many formulations are completely non-toxic, may be used safely in contact with foods, drugs or solutions which must be kept free from metal or sulphur pick-up.

Tygon's physical properties are interesting, too. Tygon, in liquid form, can be applied like a paint to metal or concrete; dries to a tough, elastic film that shrugs off corrosive fumes or acid spillage. Solves the problem of protecting structural steel, tanks and other exterior surfaces.

Tygon sheet stocks, 3/32" thick, serve as an effective long-lived lining for tanks, ducts, pipe and other process equipment, particularly for handling strong oxidizing agents such as nitric, chromic, strong concentrations of sulphuric acids, and bleaches.

Tygon cut, molded, and extruded gaskets further extend the range of usefulness of this versatile material.

Tygon flexible plastic Tubing offers a better, simpler way to pipe many corrosive solutions, and gases, as well as liquid foods, and beverages. Available in bores from .120" up to 2", Tygon Tubing may be clear or opaque, as well as outer-braid reinforced for high pressures.



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It's worth checking into — one of the many Tygon flexible plastic formulations may well provide the answer to your tough corrosive problems.

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THE Chementator

Reg. U.S. Pat. Off.

Prepared under the editorial direction of Joseph A. O'Connor, News Editor

New way to get aromatics

Houdriforming, a new continuous process for catalytically reforming petroleum naphthas, developed by Houdry Process Corp., yields not only high-octane gasoline but also benzene, toluene and xylenes.

The catalyst, which lasts a long time and can be regenerated in place, effects conversion of low-octane paraffinic constituents to high-octane gasoline. Other constituents of petroleum naphthas are converted into benzene, toluene and xylenes.

Another important feature is that sulphur compounds are removed and do not otherwise affect the process. As a byproduct, substantially pure hydrogen is produced in volume.

Houdriforming will help to ease critical shortages of xylenes, toluene and particularly benzene; these aromatics are urgently needed for synthetic rubber, plastics and synthetic fibers. The new process also means more vital aviation gasoline. And its volume output of high-octane gas will offset in part the shortage of tetraethyl lead, so essential to today's high-octane fuels.

More titanium needed for rearmament

Defense Minerals Administration wants Du Pont and National Lead each to build a plant to make 10 tons a day of titanium metal. Du Pont is sizing up this proposition.

Almost all the titanium metal now made is going into the rearmament program. Du Pont has been turning out 500 lb. a day of sponge titanium at its Newport, Del., pilot plant, is just now putting into operation a small commercial plant at Newport to make 2 tons a day. The new plant has five parallel units.

Sponge titanium is produced by reacting titanium tetrachloride with molten magnesium to strip the chlorine from the titanium, which is then separated from the byproduct magnesium chloride.

Box score on fast tax writeoffs

Chemicals accounted for 11.9 percent of the total expansion certified up to April 13 under the fast tax writeoff program in the industries processing basic materials.

These industries include metal shapes and forgings, textiles, pulp and paper, gasoline and fuel oils, and chemical products. Total amount applied for by this group was $1,493,400,000, which, at an average allowance of 63.6 percent, came to $949,400,000 on a tax amortization basis.

Total amount applied for in chemicals was $441,300,000. At an average tax writeoff allowance of 52.1 percent, this came to $230,000,000.

Grand total applied for up to April 13 by all industries totted up to a whopping $4,709,000,000, which, at an average 69.1 percent, meant $3,253,300,000 on a tax amortization basis.

Two newcomers to M-45

M-45 is the master chemical order under which NPA tries to ration short-supply chemicals among the all-too-many users. It's rapidly being enlarged by schedules—amendments placing specific chemicals under the order's provisions.

Latest items now allocated under M-45 are polyethylene and resorcinol. Polyethylene is an Appendix B item, so the seller has to apply for NPA authorization and the buyer to certify the uses. Resorcinol is a higher-rated Appendix A item. Both seller and buyer have to get specific NPA authorization on resorcinol.

Resorcinol: expansion West and East

URGENT NEED—Moves are afoot to overcome the critical shortage of resorcinol, essential ingredient in adhesives, resins and other products urgently needed for defense. A new producer will build the first resorcinol plant on the Pacific Coast. And one of the present producers has a major expansion under way. NPA is fostering these moves.

WEST COAST—First resorcinol plant on the West Coast will be built at Tacoma, Wash., if NPA gives the nod to the Chemical Division of the Borden Co. It will produce 1 million pounds annually, maybe even more, depending on how much construction the government authorizes.

Borden picked the Tacoma area because the benzene, caustic soda and sulphuric acid from which resorcinol is made are all available in the Pacific Northwest. And resorcinol is in demand there for such adhesive uses as plywood patching, plywood glue catalyst and timber laminating. What's more, low-cost byproducts from the process can be sold locally to the paper industry.

(Continued on page 72)

Borden produces nearly half the nation's resorcinol adhesives, with a synthetic resin plant at Springfield, Ore., and a dry glue plant at Seattle. It now must buy its resorcinol from Koppers, which makes it in Pennsylvania.

EAST COAST—In the other expansion move, Heyden Chemical plans to triple production of resorcinol. Its plant at Garfield, N. J., partially destroyed by fire in February, now is being rebuilt with doubled capacity of 600,000 lb. annually. NPA is helping Heyden to get the plant into production. Heyden will also ask NPA for a certificate of necessity to construct additional plant capacity to raise resorcinol production to 1 million pounds annually. Plans for this additional capacity are now being engineered.

OUTPUT—Total U. S. resorcinol production currently is estimated at about 4 million pounds. At present, there are only two producers: Koppers, the biggest, and Heyden.

USES—Three major uses of resorcinol, each taking about a third of the national output, are: adhesives, hard resins for rubber, and tire cord sizing. Resorcinol needs of the adhesives industry for 1951 are estimated at 1.5 million pounds, half to be taken by Borden.

PRICE—Resorcinol resin adhesives continue in demand despite the climbing price of resorcinol. Since the end of World War II, the delivered price of technical grade resorcinol has jumped from 50c. per lb. to 80c.

Acetylene from natural gas

Production of acetylene by the partial oxidation of methane at high temperature has worked so well that Carbide & Carbon Chemicals Co. plans to expand its Texas City unit, first commercial installation of its kind in the U. S. But first the government will have to give the go-ahead on priorities and certificates.

Natural gas and tonnage oxygen are the basic raw materials for this Sachse process. Methane and oxygen combine to produce a gas mixture containing essentially acetylene. The Texas City installation includes a unit for purification of the acetylene, one of the most difficult parts of the process. Carbide will make the resin intermediates vinyl chloride and vinyl acetate from the purified acetylene.

Partial oxidation requires less power than any known electric process for producing acetylene. It's expected to play an important part in the manufacture of such industrial chemicals as vinyl chloride, acrylonitrile and acetic acid. Many of these chemicals are also made from ethylene, but some are made from acetylene exclusively. These include vinyl acetate, trichloroethylene and chloroprene.

Commercial operation of the partial oxidation process is likely to be confined to large-scale installations in areas having abundant natural gas, and to locations where the acetylene can be utilized close to the point of manufacture. Thus at Carbide's Texas City plant the basic raw materials, methane and oxygen, are to be had at relatively low cost. And the acetylene will be used right in the same plant to produce vinyl resin intermediates.

Coming up, more aluminum

Aluminum expansion has taken two big steps forward. In the U. S., Aluminum Co. of America has finally settled on Wenatchee, Wash., as the site for a 170 million pound reduction plant. In Canada, Aluminum Co. of Canada, Ltd., is off to a start on a huge development in British Columbia and Quebec.

At Wenatchee, Alcoa is assured of the 170,000 kw. it will need as a result of negotiations with the Bonneville Power Administration and the Public Utility District of Chelan County, Wash. The reduction plant will cost $40 million.

Up in British Columbia, Alcan will build an aluminum reduction plant at Kitimat. It will turn out 175 million to 220 million pounds annually. Capital expenditure is estimated at $160 million.

In another expansion move, Alcan is building a power plant at Chute Savanne in Quebec at a cost of $60 million. And the company has started a $45 million reduction plant in Quebec. New capacity there, with the new plant in British Columbia, will boost primary aluminum production by 330 million pounds.

Ferrochrome futurity

To Chromium Mining & Smelting Co. the production of ferrochrome from low-grade Montana chromite looks like a winner. To back its hunch, the company is thinking about putting down $1.5 million to build an electrometallurgical plant at Glendive, Mont. Most touted capacity: 2 million pounds a month. If the plant is built and pays off, it will be kept running even after the current emergency.

More soda ash from Wyoming

Output of soda ash in the West is in for a big rise. Food Machinery & Chemical Corp., stepping up production of ash at Westvaco, Wyo., will construct refining facilities capable of turning out 300,000 tons per year. That's about 82 percent of current total natural soda ash capacity in the West.

Food Machinery will set up a new subsidiary to take over the trona mining and soda ash business at Westvaco, now handled by its Westvaco Chemical Division. Food Machinery will turn over $4.5 million in cash to the subsidiary, which may get another $2 million by selling 20 percent of its stock to National Distillers. The subsidiary may spend $2.7 million to improve mining.

The Westvaco operation in Wyoming is the only one outside California producing natural soda ash. Before its merger with Food Machinery in 1948, West-

(*Continued on page 76*)

What the experts demand...

ELECTRUNITE

Pressure Tubes provide!

Expanded Tube Joints

The making of expanded tube joints in tube sheets of unfired pressure vessels was discussed in a paper by **F. F. Fisher** and **G. J. Brown**, both of The Detroit Edison Company. The authors reviewed present-day practice of rolling-in such tubes and presented information gained from installing, retubing, testing and repairing many types of heat-exchangers.

They recommended that the optimum degree of expanding be determined by tests conducted in advance of actual rolling operations and that the information so obtained be recorded and made available to others. Preference is given to the automatic relay-operated technique for uniform tube rolling.

As to the finish to be given tube holes, it was pointed out that rolled joints are primarily friction joints and that their holding strength depends upon the pressure and roughness between the contacting surfaces. On the other hand, pressure tightness is best obtained by use of smooth contact surfaces. For example, relatively rough tube holes can be used in heat-exchanger work if the tubes are much softer than the tube sheet. But if the tube material is hard, greater movement is produced between the contacting surfaces, and the axial flow of tube metal may shear or smooth off any roughness of the tube hole. For this reason the tube holes in boiler construction are reamed cylindrical and smooth and the reinforcing grooves are placed near the zone of minimum movement of the tube metal.

In order to bring out the full strength of a joint without undue distortion or damage to the tube sheets and headers, the tube metal should be softer than that of the tube sheets or headers.

When power engineers describe the qualities they want in pressure tubes, it all adds up to a description of ELECTRUNITE Tubes. Look, for example, at the list of desirable properties abstracted from the paper delivered by F. F. Fisher and G. J. Brown, of Detroit Edison Company, at the Seventy-first Annual ASME meeting in New York . . .

PROVED . . . Over 250 million feet of ELECTRUNITE Pressure Tubes are in service in boilers, heat exchangers and condensers of all sizes, output, and types. Republic's research and experience assure you of field-proved tubes for every requirement.

SMOOTHNESS . . . tube contact surfaces are smooth and free from rolled-in scale and scale pits. Because ELECTRUNITE Pressure Tubes fit tube-sheet holes accurately, they roll-in tighter every time.

DUCTILITY . . . no other pressure tube can give you more ductile properties than ELECTRUNITE Tubes. They bend smoothly and uniformly to permit rapid fabrication and trouble-free erection. They are easy to roll-in, and provide maximum tightness in the tube sheets.

UNIFORMITY . . . ELECTRUNITE Pressure Tubes are uniform in grain structure, have predictable rolling-in characteristics . . . no slivers, hard spots, or scabs to cause costly delays. Wall thicknesses are uniform, tubes are fully concentric, tube strength is uniformly high.

Let us send you a copy of Bulletin BT-12 . . . it describes ELECTRUNITE Pressure Tubes for boilers and process equipment.

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STEEL AND TUBES DIVISION
224 EAST 131st STREET
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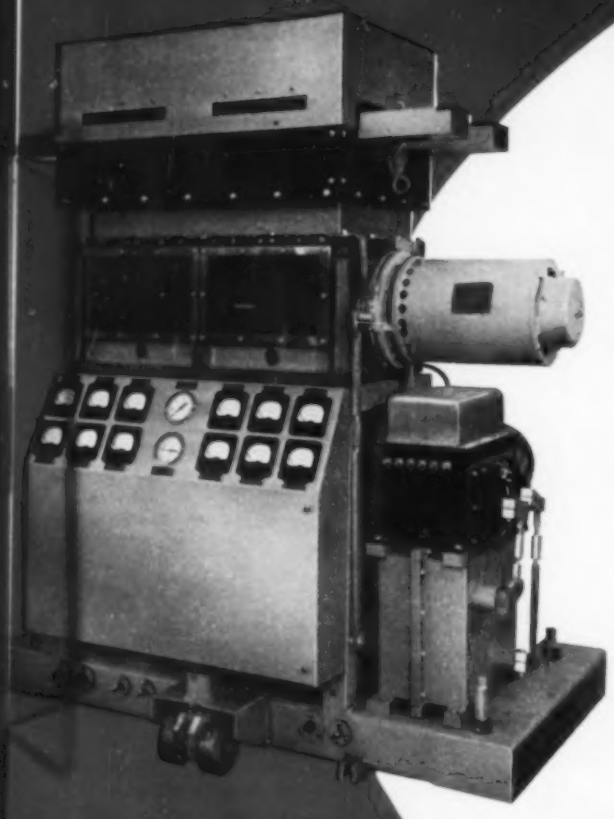
ELECTRUNITE

BOILER, CONDENSER AND HEAT EXCHANGER TUBES

SEVEN I-T-E MECHANICAL RECTIFIERS



The heart of the I-T-E Mechanical Rectifier—one 10,000 ampere contact mechanism with contacts enclosed in box on top. Driving eccentric can be seen through windows. At right is the drive motor, with the automatic regulator below. The 12 indicating instruments show the timing of each contact while the mechanism is running and carrying load.

I-T-E Mechanical Rectifiers are available in the following ratings: 4,000—5,000—6,000—7,000—8,000—9,000—and 10,000 amperes, in any voltage from 50 to 400 volts d-c. Primary voltages: 2,300 to 46,000 three-phase a-c.

Two years ago, Buffalo Electro-Chemical Company, Inc., Buffalo, N. Y., installed two I-T-E Mechanical Rectifiers, the first mechanical rectification units ever built in this country.

This pioneering spirit of Buffalo Electro-Chemical's progressive management justified itself to the extent that at present I-T-E has orders for five more Mechanical Rectifiers—to augment Buffalo's current modernization program.

I-T-E's Mechanical Rectifier has benefited Buffalo Electro-Chemical—and can handle your low voltage power conversion requirements more effectively.

1 **HIGHER EFFICIENCY**—actually 96% or more in the 100 to 400 volt range, because silver to silver contact minimizes voltage drop in rectifying element.

2 **SPACE SAVINGS** — extremely compact grouping of all operating and protective apparatus.

3 **EASY, LOW-COST INSTALLATION**—unit assembly at factory allows "packaged" delivery, easy installation. No special structural foundations are required; no crane service is needed in rectifier room.

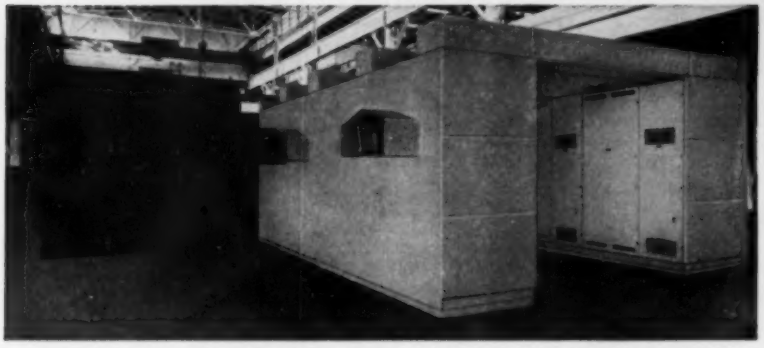
4 **SIMPLE, LOW-COST MAINTENANCE**—maintenance is almost entirely mechanical, requiring no trained personnel, complicated tools or instruments for servicing.

5 **SIMPLE OPERATION**—push-button starting without preliminary warm-up of any kind; immediate connection to load.

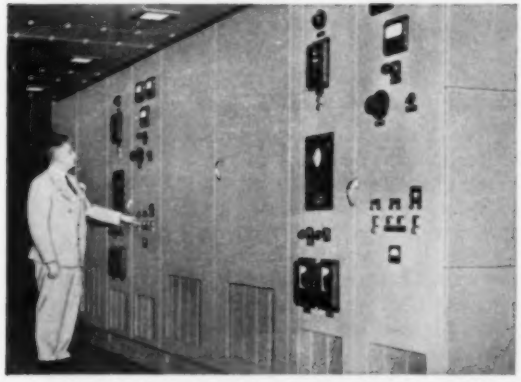
6 **SAFETY**—use of low voltage in your cell room increases safety to operating personnel and equipment.

FOR BUFFALO ELECTRO-CHEMICAL

TYPICAL I-T-E MECHANICAL RECTIFIER ARRANGEMENTS



Factory assembly of two 10,000 ampere units with outdoor transformer (only one of two shown), throat connection through wall rectifier enclosure, operating aisle and d-c switchgear compartments.



Close-up of control and instrument panel. The thoroughness of I-T-E engineering is illustrated by the overhead lights, furnished with the installation and assuring proper illumination of the control panel.

View looking through operating aisle, rectifier enclosure and control panel to left, d-c switchgear to right, interconnecting d-c bus overhead.

I-T-E

R&IE

MECHANICAL RECTIFIERS

I-T-E Circuit Breaker Company, [illegible]

Power Switching Equipment: [illegible]

Canadian Mfg. & Sales: [illegible] • Export Sales: [illegible]

MECHANICAL RECTIFIERS • SWITCHGEAR • AIR CIRCUIT BREAKERS • METAL CLAD SWITCHGEAR • SMART SWITCHING • METERING • SPECIAL PRODUCTS

vaco had put down a 1,500-ft. shaft and built a trona calcining plant there in 1947. Trona beds vary in depth from 1,100 to 1,800 ft. At capacity, soda ash is produced at a rate of about 30,000 tons per year.

New Hooker plant in Michigan?

Officials of Hooker Electrochemical Co. have been inspecting possible sites in western Michigan for an $8 million plant. Some places they've looked over: Grand Haven, Manistee, Muskegon and Ludington. Michigan's brine is the lure.

Scraping up sulphur

A rash of sulphur recovery projects has broken out in the Southwest and on the Gulf Coast. And in Mexico sulphur production is to be expanded.

Consolidated Chemical Industries will build a $500,000 plant next to Esso's Baton Rouge, La., refinery. It will recover about 30 tons a day of sulphur from waste refinery gases. The sulphur will be used to produce sulphuric at Consolidated's nearby acid plant.

McKamie Gas Cleaning Co. will process sour gas at its Magnolia, Ark., plant to produce the equivalent of 150 tons of sulphur daily.

Crude sulphur will be recovered from waste gases at casinghead gasoline plants by the Odessa Natural Gasoline Co. and the Sid Richardson Carbon Co. These companies will build a $200,000 plant at Odessa, Tex., next to the gasoline plant of Odessa. Recovery is estimated at 20 tons of sulphur per day from the 25 tons now being burned as waste.

Mexico, meantime, will expand sulphur production. The Export-Import Bank has loaned $1,875,000 to Mexican Gulf Sulphur Co. and its subsidiary Mexican Sulphur Co. to finance production. Plans call for 200,000 tons of sulphur a year. The plant will be located on the Isthmus of Tehuantepec, near the petroleum refining center of Minatitlan.

CIO Chemical Workers veto war chest

While other unions are building up larger strike funds, the members of the CIO Gas, Coke & Chemical Workers have refused to contribute 25 c. a month to start a strike war chest.

In a referendum ordered by the union's convention, the strike fund didn't even get a majority vote. The vote was 13,092 to 11,722 against the fund, with less than half the claimed 56,000 members voting.

Secretary-Treasurer Cecil Martin says the poor turnout of voters reflects "lack of interest" and a refusal to back up the convention delegates on an important issue. Ninety-nine locals did not vote at all.

The 25-c. monthly contribution would have gone into a fund from which strikers could draw $10 a week beginning the third week of a strike. A reserve of $75,000 was to have been accumulated before payments would begin.

In contrast, the powerful CIO Auto Workers, headed by Walter P. Reuther, has increased its dues from $1.50 to $2.50 a month. Twenty-five cents of the increase will go into a strike fund. The union has no-strike contracts in the auto industry running until 1955. During that time, the fund will build up to a juicy $15 million.

Will chemical wages creep up?

Pressure against wage controls comes from the many large union contracts that are subject to negotiation on wages this year and from others that call for automatic increases based on the cost of living.

Going through its files, the Bureau of Labor Statistics has examined the wage status of 188 contracts, each covering at least 5,000 employees. Included are three in chemicals. Largest is American Viscose's contract with the CIO Textile Workers, covering 15,500. It expires in November, but is reopenable on 60-day notice after June 1.

Another is the textile union's contract with Celanese at Cumberland, Md., covering 5,500. It expires in August.

The third, between Dow Chemical, Midland, Mich., and UMW, District 50, affecting 5,400, has a cost-of-living adjustment quarterly and also a 4-c. annual improvement increase in July. It runs until July 1953.

Toward a new cortisone process

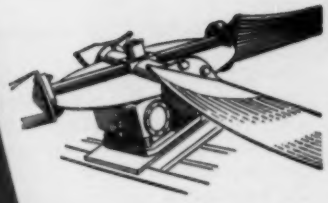
Merck chemists have successfully converted each of four steroids found in nature into a steroid more closely resembling cortisone. Synthesis of this steroid could lead to a new large-scale process for the production of cortisone.

Getting an oxygen atom into the 11 position in these naturally occurring steroids has been the big stumbling block. But Merck chemists have now overcome this obstacle. They've converted ergosterol, cholesterol, stigmasterol and diosgenin into 3-acetoxy-11,20-diketo *allo*pregnane, a steroid with an oxygen in the 11 position.

The need to find raw materials other than bile acids for the production of cortisone has touched off research in many laboratories. Chemists are meeting the challenge through two approaches: (1) total synthesis of cortisone from simple, commercially available compounds (the synthesis of a steroid from ortho toluidine by R. B. Woodward's group at Harvard is a long step forward in this direction); and (2) conversion of naturally occurring steroids to cortisone.

Merck is pushing research on new processes, in-

(*Continued on page 78*)



Cleveland Cooling Tower Drives (built in sizes 50 CU to 500 CU inclusive) are rated under Class 2 service conditions, except that thermal limitation does not apply. Heavy, externally ribbed housing effectively dissipates heat to air stream.

Cleveland Type CU...ideal drive for cooling towers

● This worm gear drive is designed specifically for cooling tower service. It meets a long-felt need for a compact, heavy duty speed reducer that will operate continuously, at high speeds and for long periods. It is inherently quiet in operation. Extreme conditions of heat and humidity do not affect it. It carries high thrust loads and high radial loads without loss of efficiency. It lends itself to rugged mounting, and due to the simplicity of its design, it is easily installed, serviced and adjusted in the field.

Every CU drive is run in and pretested under load before it leaves the factory. Thousands of units now in use prove its reliability in all classes of service—in the oil fields, in industry, in air conditioning systems in commercial and public buildings—in short, wherever there's a cooling tower, you can depend on CU.

Write for Bulletin 135 for full description of Type CU. Ask also for free literature on other Cleveland units. The Cleveland Worm & Gear Co., 3273 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND
Worm Gear
Speed Reducers

cluding total synthesis. Meantime, it continues development work on the present manufacturing process, and has additional production facilities under construction at its Cherokee plant near Danville, Pa. All present planned production is urgently needed; demand for cortisone far outstrips supply.

New lithium process

Foote Mineral Co. has developed a new process to meet the growing demand for lithium. By fall, Foote will have completed a $214,800 expansion at its Exton, Pa., plant; it will double the company's production of lithium in the primary refining stage.

The new facilities will process lithium ores mined at Foote's recently acquired Kings Mountain, N. C., source.

Grease thickener from sand

Du Pont may build in a year or two a commercial plant to manufacture its new GS silica, a grease thickener derived from sand. Now in pilot-plant production, it promises a grease with outstanding resistance to heat, water and mechanical breakdown.

Ordinary greases, made with soap as the thickening agent, become thin at high temperatures. This may result in increased wear on bearing surfaces and the leaking of lubricant from gear and bearing housings. Greases thickened with GS silica retain their consistency as the temperature rises.

Silica greases are still in the experimental stage. But in the laboratory such a grease has stood up in tests simulating the punishment that would be inflicted on wheel bearings in a truck driven in a tight turn at 50 mph. for 10,000 mi.

The lightweight or "fluidized" properties of the new silica are due to the spherical shape of the particles, which permits plenty of air space between particles, and to the extremely fine size of the particles. The new silica comes in the form of white balls less than a millionth of an inch in diameter.

Briefly, here's how it's made: high-purity sand is heated with soda ash to produce sodium silicate. Ion exchange pulls the sodium ions out of a dilute solution of the sodium silicate, leaving silica. The new Du Pont silica floats on water, due to a special treatment of the minute particles.

Another sulphur source

JACK IN THE GOB PILE—Aware of the quest for sulphur from all sources, Peabody Coal Co. of Chicago has been eyeing the mountainous piles of coal waste at its sprawling Taylorville, Ill., mines and wondering whether it can profitably recover the sulphur from these "gob piles."

HIGH-SULPHUR COAL—Central Illinois bituminous coal, mined in the Taylorville area, is high in sulphur content. Tests show that coal in the gob piles contains from 12 to 13 percent sulphur.

RECOVERY—Vernon Leach, chief engineer for Peabody, has called in Singh & Co., consulting chemical engineers, to explore the possibilities of recovering sulphur from the waste coal. Dr. A. D. Singh, president of the consulting firm, estimates that at least 80 percent of the gob pile sulphur, or nearly 300 tons of the element a day, might be recovered.

COST ESTIMATES—Singh has made estimates for different kinds and sizes of recovery plants. A plant processing 50 tons of waste an hour would cost $1,345,000 and should produce 130 tons of elemental sulphur daily. A plant double that size would cost $2,540,000 and should turn out 260 tons of sulphur per day. He estimates the cost of the sulphur at $13.75 for a 50-ton-an-hour plant, and at $10.35 for a 100-ton-an-hour plant. These costs compare with the present Gulf Coast sulphur price of $22 a ton plus freight.

Titanium ester paint resists fire

The hazard of shipboard fires may be reduced by Du Pont's new experimental paint based on a titanium ester. Coatings of the new paint failed to burn even after an hour at 650 deg. F. Other test panels didn't burn when brought to a dull red heat at about 1,300 deg. F.

Big problems still to be licked: making the paint adhere to metal satisfactorily and getting it to resist salt water attack.

When titanium tetrachloride reacts with isopropyl alcohol the liquid compound tetraisopropyl titanate is formed. This is formulated with aluminum flake in making the paint. When the paint is applied, tetraisopropyl titanate reacts in 2 or 3 min. with the moisture in the air to form titanium dioxide and isopropyl alcohol. The alcohol evaporates quickly, leaving an interlocking film of titanium dioxide and aluminum.

More sulphuric for Intermountain area

Demand for sulphuric acid in the West, particularly for the production of superphosphate fertilizer, keeps growing. It will be met in part when Garfield Chemical & Manufacturing Co. puts into operation this July at Garfield, Utah, facilities to raise the output of sulphuric acid to 500 tons daily. Source of the acid: sulphur dioxide emitted from the converters at the copper smelter of American Smelting & Refining at Garfield.

Despite the increase in acid output from 250 tons to the new level of 500 tons daily, Garfield Chemical officials believe that acid requirements of the Intermountain region will still tax the supply. Garfield will supply the sulphuric acid needs of the new catalyst plant built by Filtrol Corp. at Salt Lake City.

—*End*

Where Quality Counts

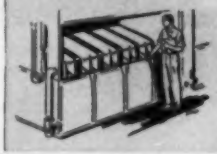
Specify

GENERAL'S

ANHYDROUS

GLAUBER'S SALT (Sodium Sulfate)

IN TEXTILE DYEING
As a Leveling Agent in the Bath



IN MANUFACTURING DYES
For Standardizing Dyes

MANUFACTURING SYNTHETIC DETERGENTS

HIGH PURITY—Due to rigid manufacturing quality controls, General's Anhydrous Glauber's Salt consistently assays 99.9% Na_2SO_4.

GOOD SOLUBILITY—Goes into solution readily and is practically free from undesirable impurities.

EFFICIENT—Produces sparkling clear solutions; helps prevent contamination of dyes or colors.

ECONOMICAL—Highly concentrated form offers economies in shipping costs.

READILY AVAILABLE—Stocked throughout General Chemical's chain of distributing stations from coast to coast.

BASIC CHEMICALS

GC

FOR AMERICAN INDUSTRY

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

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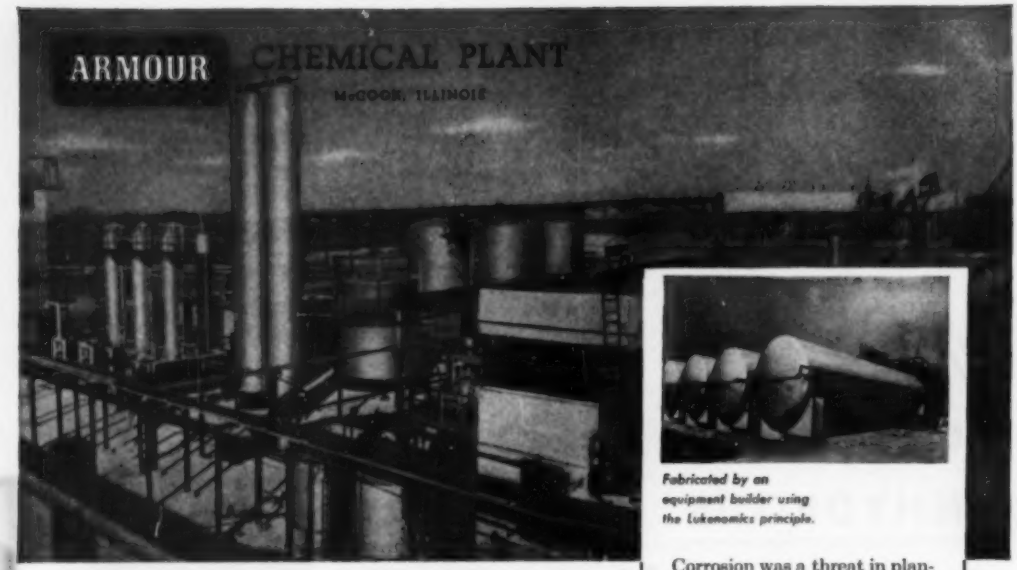


Fabricated by an equipment builder using the Lukenomics principle.

An Answer to Corrosion

... from a problem in Nitriles

Is faltering equipment shooting blanks at any of *your* output targets?

Perhaps a tighter lid on corrosion threats would help. Or a heavier padlock on upkeep costs. Or a new anchor on down-time. For these results—as built into these clad steel nitrile tanks—are typical of improvements that progressive builders can often still produce . . . even in the face of shortages.

Need new equipment? Or new vitamins for present units? Builders like this—through coordination of design resources—can explore your problem, deliver potentials you may not even expect.

They apply *Lukenomics*, for example, combining their knowledge, and that of designer and engineer, with our own concerning materials, their production and use. It's *bonus* brainpower . . . trained on your needs. Get in touch with such builders! Outline your problem today. Manager, Marketing Service, Lukens Steel Company, 400 Lukens Building, Coatesville, Pa.

Promote steel production generally—speed sale of your scrap.

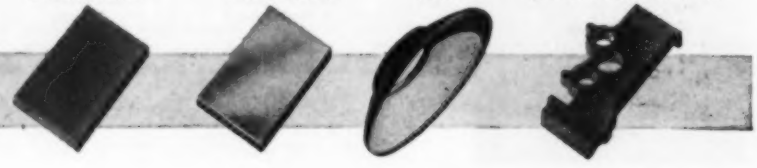
Corrosion was a threat in planning a nitrile process for the Armour Chemical Plant in McCook, Ill. Unsaturated acids and moisture would cause fatty acids to attack iron. Presence of iron salts would threaten instability, discoloration. Coordination of design resources enabled the builder to fabricate a series of tanks of Lukens Stainless Clad Steel. Results: assurance of product purity, an end to corrosion danger, virtual elimination of iron pick-up, low initial costs. And by using *clad*, an important saving was made in critical metals. *This is Lukenomics at work.*

LUKENS

LUKENS STEEL COMPANY

OVER 140 YEARS' EXPERIENCE AS THE WORLD'S LEADING PRODUCER OF SPECIALTY STEEL PRODUCTS

STEEL PLATE | CLAD STEELS | HEADS | STEEL PLATE SHAPES



Stainless Clad Steel by LUKENS . . . Fabrication by GRAVER

For Armour's great new chemical plant near Chicago . . . designed to process annually up to 100,000,000 pounds of fats and oils . . . Graver furnished 42 tanks and vessels—some of stainless clad, others of carbon steel.

To combat corrosion and prevent discoloration of the fatty acid stocks, stainless was used in such fabrications as *four horizontal feed tanks* (shown below) each 12′ dia. x 52′ long . . . made of type 304—10% clad stainless steel—*two insulated cone roof storage tanks*, each 15′ dia. x 18′ high, 21,000 gal. cap . . . type 347—20% clad stainless steel—*two settling tanks*, each 11′6″ dia. x 14′ high . . . type 347—20% clad stainless steel on bottom and first ring.

These and the other Graver tanks serve an important purpose in the production of purified fatty acids and the conversion of the resulting products into a series of new chemicals for many industrial uses.

GRAVER TANK & MFG. CO., INC.
EAST CHICAGO, INDIANA
NEW YORK • CHICAGO • PHILADELPHIA • WASHINGTON
DETROIT • CINCINNATI • CATASAUQUA, PA.
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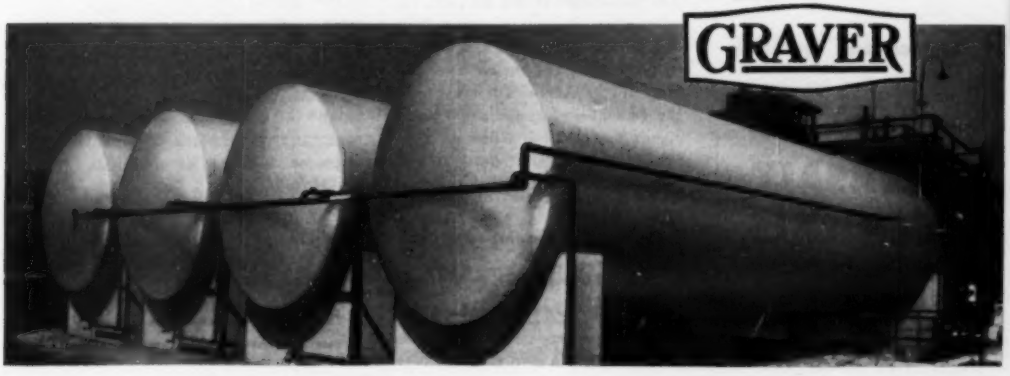


NOW— install wear plates with a trowel

...a new way to protect equipment from erosion and corrosion

PENNSALT CHEMICALS

for Industry • Agriculture • Health • Home

Progressive Chemistry for over a Century

By combining Penchlor FCC Cement and a steel gridwork you can literally install "wear plates" with a trowel . . . thus solving the twin problem of erosion and corrosion.

The construction shown has met with outstanding success in lining fluid catalytic cracking equipment, such as cyclones, feed and return lines and large fittings. At points of severe wear the cement-steel combination withstands the abrasive action of high-velocity, fine catalyst particles and resists sulfation by petroleum gases at temperatures of 1250°F. and higher.

In addition, when you use Penchlor Grid Linings you can often design a less expensive wall section thus saving critical material by taking advantage of the wearing properties and resistance to thermal shock offered by this method.

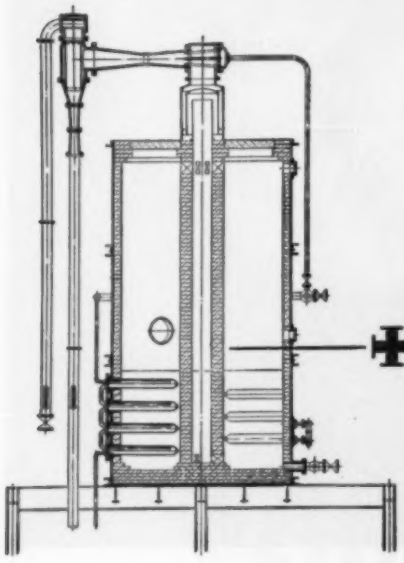
For further information on this, or other Penchlor FCC Cement uses, write Pennsylvania Salt Manufacturing Company, Industrial Chemicals Department, 1000 Widener Building, Philadelphia 7, Pa.

5 Important Advantages of Penchlor Grid Linings

1. Replace more expensive high-alloy steels.
2. Fast "return to service"—short curing time.
3. Long life. Penchlor Linings have been in service for over 3 years without extensive repair . . . over twice the life of former linings.
4. Penchlor gains hardness while in service.
5. Penchlor offers total resistance to many corrosives.

You get a big PLUS . . .

. . . when you recover acid the Simonson-Mantius way



Is it time to review your stand on acid recovery?

. . . time to take a fresh look at it in the light of today's sulfur prices? The current sulfur shortage? Increasing community pressures?

Many acid users feel it is. And if you feel so, too, it will pay you to bring yourself up-to-date on the advantages of the Simonson-Mantius Vacuum Process.

You get efficient, economical recovery of your spent acids. Your acid losses, due to distillation and entrainment, are reduced to a minimum.

You also get this important plus: fumeless operation. Fumeless because it's effected in closed vessels, under vacuum.

For over a quarter of a century, Simonson-Mantius equipment has been operating with low cost and high efficiency in plants using sulfuric acid for processing. The experience gained by our Acid Recovery Department during this time can be brought to bear on your particular acid recovery problem.

Why not ask our engineers to discuss the matter with you?

NATIONAL LEAD COMPANY *

Acid Recovery Department

111 Broadway, New York 6, N. Y.

*Reg. U. S. Pat. Off.

THIS IS THE ANSWER TO YOUR "CAKING" PROBLEMS

DAVISON FINELY-SIZED SYNTHETIC SILICAS

Where caking is a problem, Davison finely-sized synthetic silicas offer double-action control. When such silicas are mixed with a granular or powdered product they not only add a thin but effective coating to the particles, but also adsorb the moisture or mother liquor that otherwise would accelerate caking. These Davison silicas are as small as .5 micron diameter with uniformity of structure insured by rigid production controls. They offer surface areas up to 1000 square meters per gram.

Being chemically and physically inert, they are adaptable in many varied applications. Davison finely-sized, amorphous synthetic silicas of high purity are currently being used as anti-caking agents in dyes, chemicals, insecticides, foods and pharmaceuticals. Davison's diversified experience and years of research are available to aid you in your caking problems. For additional information, specifications and samples of Davison silica gel write, mentioning your proposed application.

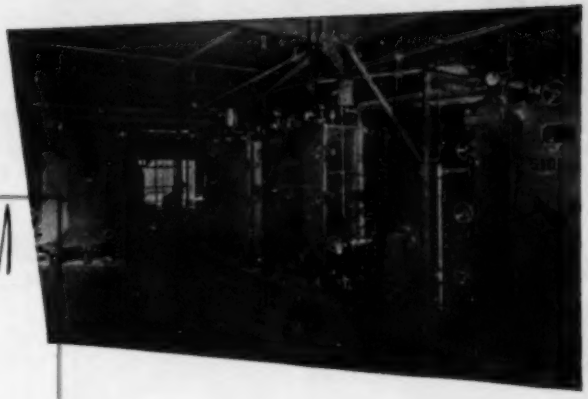
Progress Through Chemistry

THE DAVISON CHEMICAL CORPORATION

Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

HOW VACUUM SAVES 66 hours on a 72-hour job



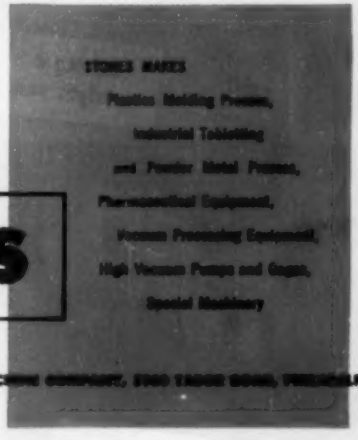
Vacuum expedites processing, reduces labor, works at lower temperatures, and often cuts costs to a fraction of those by other methods. Drying, impregnating, distilling, sublimation, and metallizing are a few of the processes for which vacuum is widely used.

Take a single example: the drying of shellac. After months in the making shellac offers stubborn resistance to the drying out of moisture . . . a 72-hour job by conventional atmospheric methods. Under vacuum, drying is done in a scant 6 hours . . . and the end-product has better physical characteristics.

Three days reduced to 6 hours . . . saving over 90% of the drying time on this process!

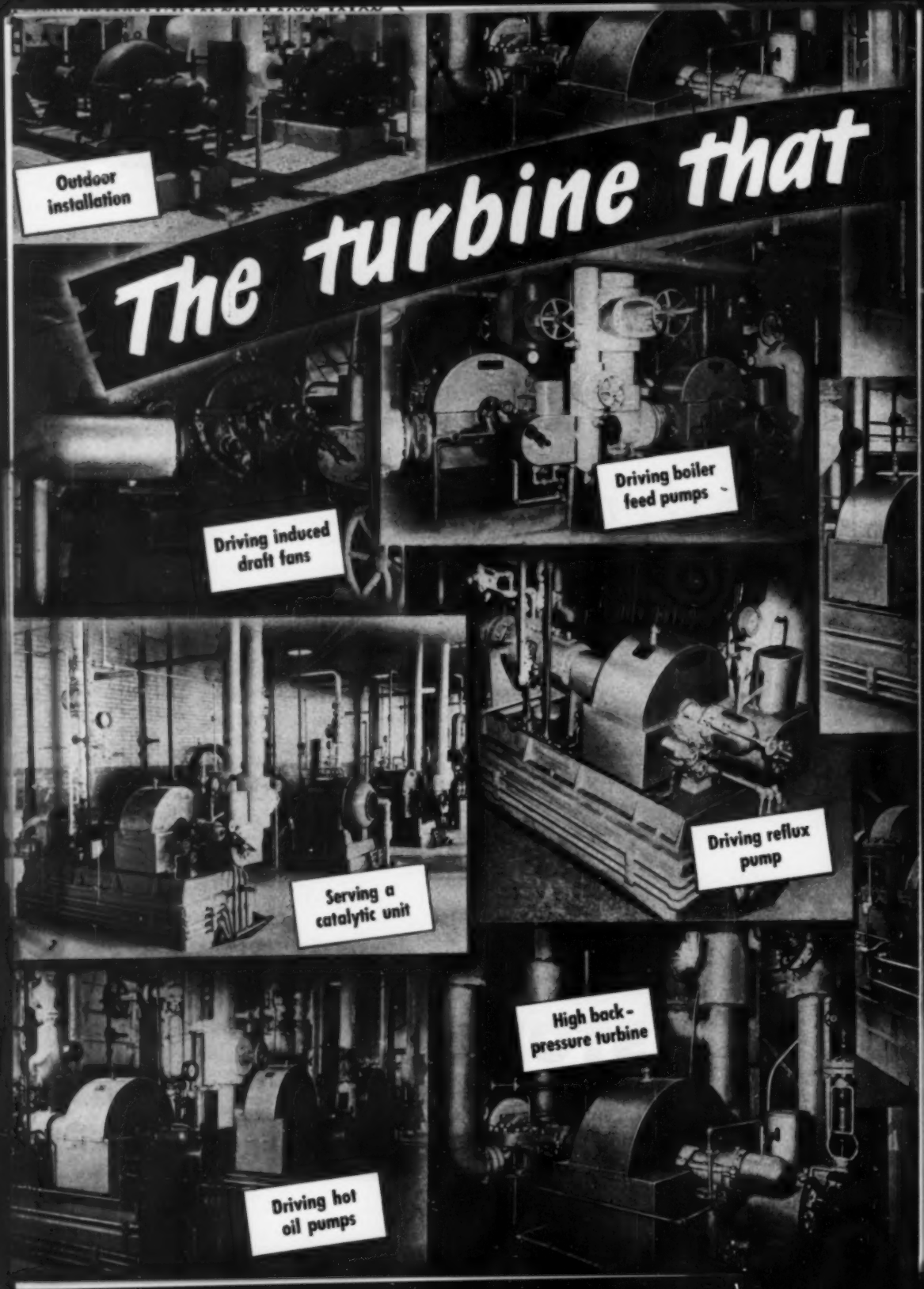
Stokes Vacuum Shelf Dryers, Stokes Condensers, Stokes Vacuum Pumps and Stokes Vacuum Gages are used for this work at Haeuser Shellac Company, Brooklyn, N.Y.

Stokes Vacuum Engineers—experienced pioneers in Vacuum Engineering—constitute an Advisory Service for you on moisture removal problems or on any of the other unique possibilities of applied vacuum. We welcome your inquiry . . . without obligation, of course.



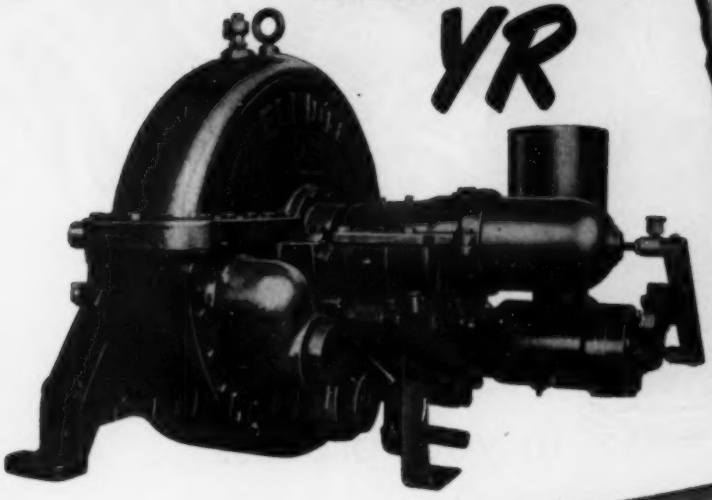
STOKES

F. J. STOKES MACHINE COMPANY, 5500 TABOR ROAD, PHILADELPHIA 20, PA.


Outdoor installation
The turbine that
Driving induced draft fans
Driving boiler feed pumps
Serving a catalytic unit
Driving reflux pump
Driving hot oil pumps
High back-pressure turbine

everyone likes...

ELLIOTT YR



Driving induced draft fans

YOU SEE THEM EVERYWHERE—in power plants, industrial and process plants, throughout the oil industry, in fact in all industries that demand reliability in mechanical drive turbines. Working indoors or out, under all kinds of conditions, operating condensing or noncondensing; sometimes operating on gas instead of steam. Although a standardized line of turbines, their flexibility results in a tailor-made unit for any type of application . . . And best of all, with the built-in dependability that lightens the load of the men whose job is to keep things running right.

Everyone likes the Elliott YR. The reasons are factually set forth in Bulletin H-16. Write for it.

Paper machine drives

ELLIOTT COMPANY

Steam Turbine Dept. • Jeannette, Pa.

Plants at: JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J. • DISTRICT OFFICES IN PRINCIPAL CITIES

H-730

Driving process pumps

In your process . . .

HOW HOT IS HOT?

To meet the requirements of today's high-temperature processes, ALCOA Aluminas are helping refractory manufacturers revise our concept of "how hot is hot." Operating temperatures that were once inconceivable are common today. Yet new processes and speeded production are pushing even those temperatures higher and higher.

Modern operators are using refractories fortified with ALCOA Alumina to increase the output of their metallurgical furnaces, chemical processing kilns, glass tanks and other high-temperature equipment. They know that these refractories *considerably reduce down time!* And down time costs more than good refractories.

Even at moderate temperatures, a *little* ALCOA Alumina in refractories makes a marked difference, but the higher the alumina content, *the better the performance.* Strength and stability are improved . . . resistance to spalling, abrasion and fluxing is increased . . . thermal and mechanical shock resistance is improved. Such refractories are being successfully used up to 3650° F.

Perhaps refractories fortified with ALCOA Alumina are the answer to *your* extra high-temperature requirements. Let us discuss them with you. We'll gladly refer you to reliable sources of supply. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 602F Gulf Building, Pittsburgh 19, Pennsylvania.

Alcoa Chemicals

ALCOA ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • GALLEYED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

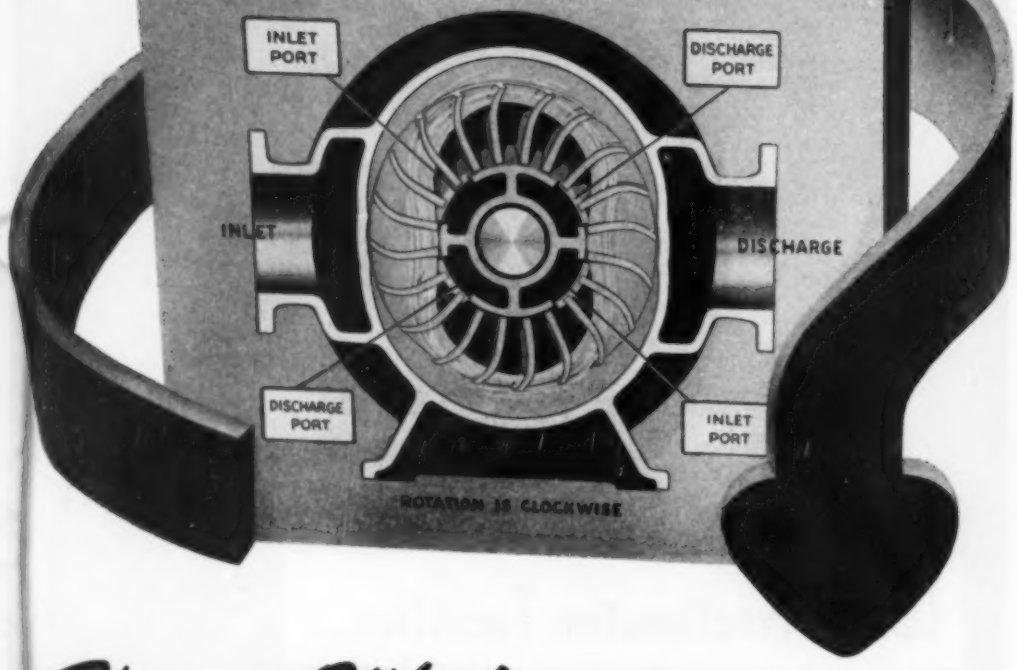
produce special solvents tailored to your needs

You'll find the special solvents produced by Roosevelt will help you produce products to meet your high-quality standards. ***Complete*** catalytic sulphur removal from Roosevelt's aliphatic naphthas means non-corrosive, chemically stable solvents, free of offensive odors . . . Flexible, Kaskade-type fractionating towers, plus constant quality-control analysis means every shipment will meet your specifications. Send us your solvent specifications today!

WRITE FOR COMPLETE INFORMATION

ROOSEVELT

Nash Instrument Air Compressors deliver only clean air, free from oil or dust, and without filters



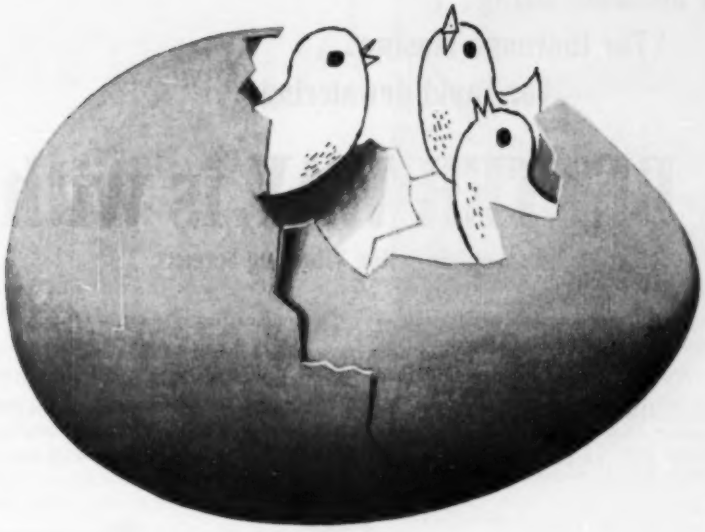
Here is Why!

You can dispense with oil filters and dust filters when you install ®Nash® Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

®Nash® Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

- No oil filters.
- No dust filters.
- No internal lubrication to contaminate air handled.
- No internal wearing parts.
- No valves, pistons, or vanes.
- Non-pulsating pressure.
- Original performance constant over a long pump life.
- Low maintenance cost.

NASH ENGINEERING COMPANY
397 WILSON, SO. NORWALK, CONN.



3 caustics in 1

This is the true story of a soap manufacturer who was buying 3 grades of caustic soda from as many suppliers. He thought he needed all 3 grades to satisfy the requirements of his various grades of soap and different processes. But it was a lot of trouble to receive, handle and store these 3 separate grades. So he brought his problem to Wyandotte.

We were able to meet all of his requirements with one grade of Wyandotte Caustic.

Are *you* buying "too many" grades of caustic? If you think you are, why not talk over your specifications with Wyandotte's Technical Service Department?

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA
CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE
HYDROGEN • DRY ICE • SYNTHETIC DETERGENTS • GLYCOLS
CARBOSE (Sodium CMC) • ETHYLENE DICHLORIDE • PROPYLENE
DICHLORIDE • AROMATIC SULFONIC ACID DERIVATIVES
OTHER ORGANIC AND INORGANIC CHEMICALS

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Wyandotte
REG. U. S. PAT. OFF.

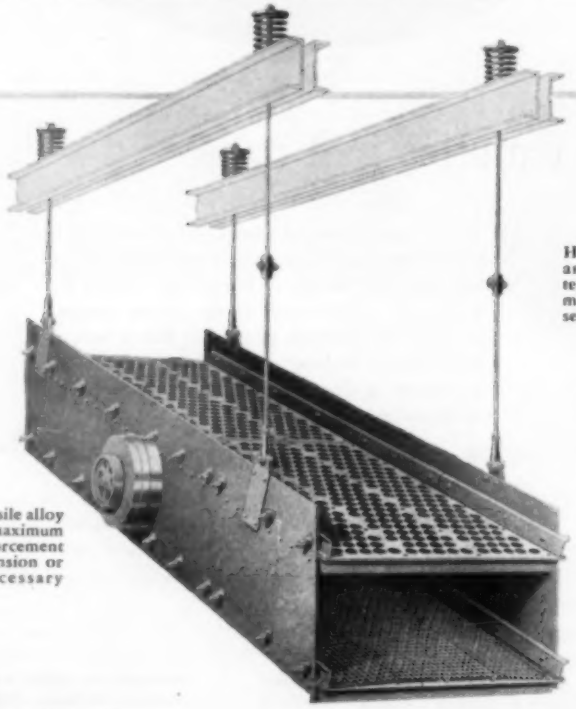
For accurate sizing...
For thorough rinsing...
For rapid dewatering...

the BETTER WAY is with CA

Concentric Action Vibrating Screens

No matter what your screening requirements — Link-Belt CA Vibrating Screens offer top efficiency. Self-aligning vibrator mechanism imparts a smooth, positive, circular motion to every square inch of every deck. Lively tumbling action gives each particle maximum opportunity for sizing, washing or drainage.

There's a standard size CA for almost every job — 3 x 8 to 6 x 16 ft. . . . single, double and triple deck . . . suspension or support mounted. Remember, when it comes to materials handling, profit-wise operators come to Link-Belt.



Two-bearing vibrator has constant bearing loads — no shock from impact of feed.

Unbalanced weights easily adjusted to amplitude of highest efficiency.

Screen box of high tensile alloy steel plate provides maximum strength. Solid reinforcement at vibrator and suspension or support insures necessary rigidity.

Husky roller bearings are completely protected from dust and moisture by labyrinth seals, steel housing.

Centrifugally-actuated, unbalanced weights eliminate excessive vibration in accelerating and decelerating.

Screen cloth is securely tensioned and clamped over rubber supports, can be quickly changed.

WRITE FOR BOOK 2354 for complete layout data

LINK-BELT

VIBRATING SCREENS

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa.) Offices in Principal cities. 12.425

HOOKER CHEMICALS

basic for: SYNTHETIC FIBERS
TEXTILE PROCESSING
DYESTUFF MANUFACTURE

Directly or indirectly, the textile industry depends upon Hooker for uniform high quality chemicals.

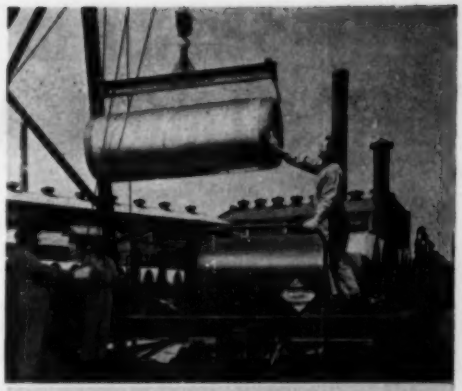
Viscose Rayon, for example, employs Hooker Chemicals all the way from the manufacture of dissolving pulp (chlorine and caustic soda) to the final production of fibers (caustic soda, lauryl pyridinium chloride, sodium sulfide, sodium sulfhydrate).

Textile Processing uses Hooker Caustic Soda for kier boiling, mercerizing, in sodium hypochlorite bleach, and as a dyebath assistant. Hooker Chlorinated Paraffin is used in formulations that make canvas water-repellent and fire-retardant.

Dyestuffs . . . Although we do not manufacture dyes, we provide over 30 dyestuff intermediates that go into the making of the finished textile product. The most important of these are listed at the right.

Special Products . . . We are interested in working with dyestuff and specialty manufacturers to develop new intermediates for use in dyes, mothproofing compounds, flame retardants, and similar products. In addition to the products we regularly supply, we have provided many new and special chemicals, on pilot plant or commercial scale. Your inquiry is invited.

FOR UP-TO-DATE DELIVERY INFORMATION . . . please keep in touch with your Hooker sales representative. He will keep you informed of any changes in the delivery situation, and will notify you promptly as materials become available.



LIQUID CHLORINE in one-ton containers—one of several convenient packages in which Hooker ships this high-purity bleaching agent.

For Rayon Manufacture and Processing

Caustic Soda	Lauryl Pyridinium Chloride
Sodium Sulfhydrate	Sodium Sulfide

For Textile Processing

Benzoic Acid	Muriatic Acid
Caustic Soda	Sodium Sulfhydrate
Chlorine	Sodium Sulfide

Chlorinated Paraffin

For Dyestuff Manufacture

Aluminum Chloride	Monochloroacetic Acid
Benzoyl Chloride	m-Nitrobenzoyl Chloride
Benzyl Chloride	p-Nitrobenzoyl Chloride
Caustic Soda	Phenyl Isocyanate
Chlorine	Sodium Sulfhydrate
Chlorobenzenes	Sodium Sulfide

• • •

For the complete list of Hooker Chemicals, send for Bulletin 100. For properties, specifications and typical uses of any chemicals listed here, ask for Technical Data Sheets. Please request them on your business letterhead.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

5 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.

New York, New York • Wilmington, California • Tacoma, Washington

HOOKER CHEMICALS

1-519

CAUSTIC SODA • CHLORINE • MURIATIC ACID • CHLOROBENZENES • SODIUM SULFIDE • SODIUM SULFHYDRATE • THIONYL CHLORIDE

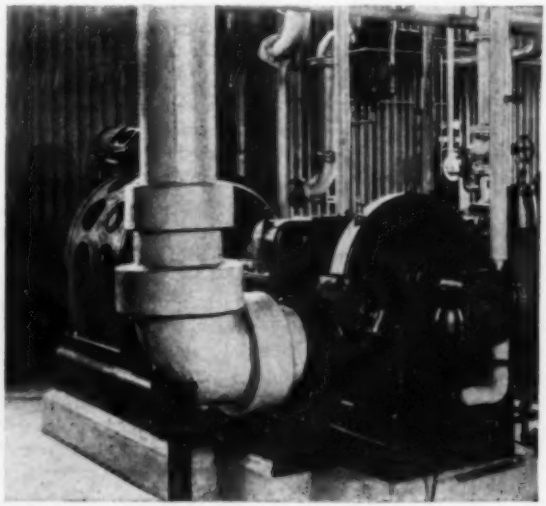
WHY STANDARD DP TURBINE DRIVES FIT ALMOST ANY APPLICATION

Here's a turbine designed by turbine users. It incorporates the features asked for by hundreds of operators interviewed in an exhaustive survey. They told General Electric they wanted a mechanical-drive turbine that would fit many types of applications—continuous process, standby, indoor, outdoor, equipment drive, generator drive, etc.

The DP answers these varied requirements with special features that are included as standard parts. For instance, you get hydraulic governing to meet critical accuracy requirements, totally enclosed construction that allows installation in hazardous atmospheres, pressure lubrication for dependable, continuous operation. These advantages are included at no extra cost—the DP is priced as a standard.

If you have steam available, the DP turbine can work profitably for you. You'll discover how its standard design gives you wide application flexibility, makes possible real savings in maintenance costs. The DP's operating record proves its reliability when there's a tough job to be done.

OUTDOOR INSTALLATIONS—No need to make special modifications when you move a DP out of doors. Totally enclosed governing system operating in its own oil atmosphere eliminates possibility of rusting or corrosion. You can operate a DP in hazardous atmospheres. Positive acting, non-sparking emergency governor protects the DP turbine against overspeed.



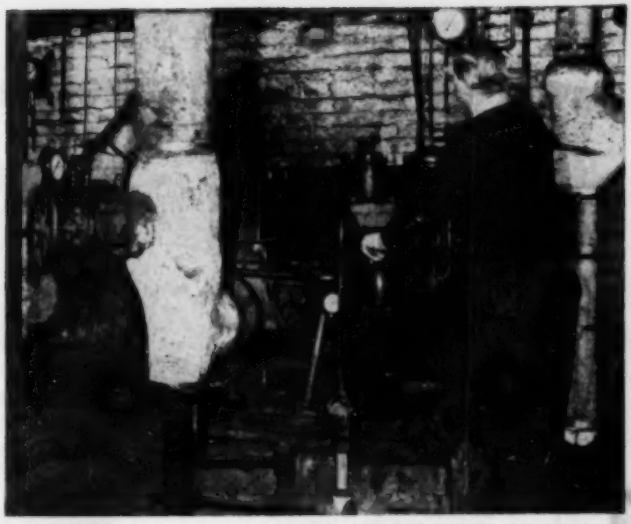
PRECISION GOVERNING—accurate enough for generator drives—is yours with the DP's hydraulic system. Regulation is 6 per cent with a 30 per cent range of speed adjustment. For process governing, regulator control is available.

Ask your General Electric representative for full details about the DP mechanical-drive turbine, or write for bulletin GEA-4955. General Electric Company, Schenectady 5, New York.

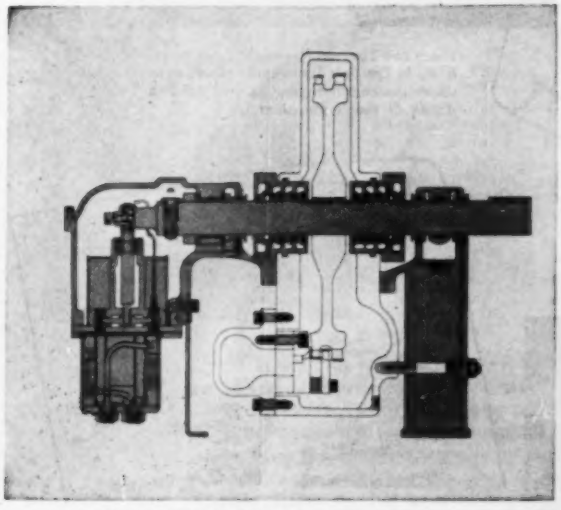
GENERAL ELECTRIC

252-50

MECHANICAL-DRIVE TURBINES



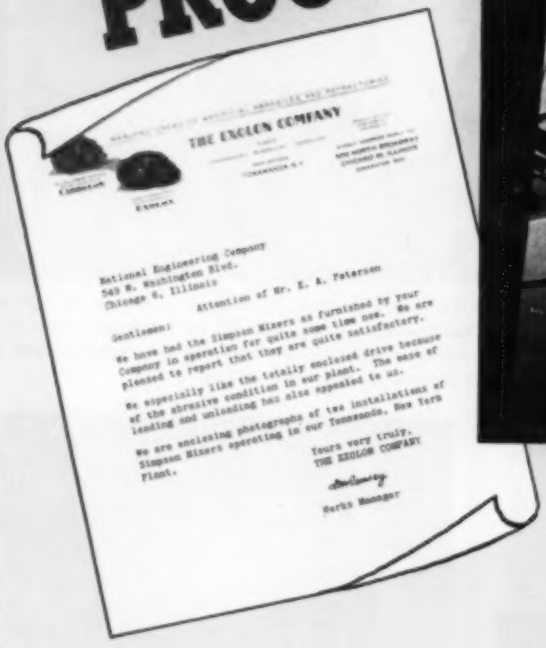
DEPENDABILITY is built into the DP. Positive lubrication through automotive-type bearings adds years to the life of the turbine. Special steel nozzle plate, self-lubricating graphite packings, and Monel-sprayed shaft are examples of design features that spell reliability.



APPLICATION FLEXIBILITY As the shaded parts in the diagram illustrate, most DP parts are identical on all frame sizes and ratings. In this way, you can adapt a DP for different job requirements with only minor changes. A different nozzle plate gives you a new horsepower output. A change in governor gears provides a new speed range. DP's are rated from 10 to 1200 HP and 1000 to 5000 rpm, and with slight modification, can deliver up to 2000 HP and 10,000 rpm. During a change in plant operation, the DP's flexibility will save you money.

EASY MAINTENANCE Because most parts are interchangeable on all models, spares can be stocked at low cost. A spare parts kit, containing 91 items, can be obtained with the turbine. This simple method of stocking spares lowers maintenance costs and provides protection for several DP's in your plant. All models, regardless of frame size, horsepower, or speed ratings, have identical shaft height, keyways, and coupling fits. Thus, installation problems are simplified; you can move these center-line supported units from job to job without a custom line-up.

HERE'S PROOF of the Results users get



THE EXOLON COMPANY

National Engineering Company
549 W. Washington Blvd.
Chicago 6, Illinois

Attention of Mr. E. A. Peterson

Gentlemen:

We have had the Simpson Mixers as furnished by your Company in operation for quite some time now. We are pleased to report that they are quite satisfactory.

We especially like the totally enclosed drive because of the abrasive condition in our plant. The ease of loading and unloading has also appealed to us.

We are enclosing photographs of two installations of Simpson Mixers operating in our Tonawanda, New York Plant.

Yours very truly,
THE EXOLON COMPANY

Purchasing Agent

These two Simpson Mix-Mullers are doing a job in Exolon's Tonawanda plant, even under the constant grinding and wearing action of tough abrasives.

View shows 4 of the Simpson Mix-Mullers referred to in the accompanying letter, used for storage battery plate paste mixing at an Auto-Lite plant.

AUTO-LITE BATTERY CORPORATION
NIAGARA FALLS DIVISION
NIAGARA FALLS, NEW YORK

National Engineering Co.
549 West Washington Blvd.
Chicago 6, Ill.

Attention: Mr. E. A. Peterson
Assistant Sales Manager

Gentlemen:

We have been using the Simpson Mixers in our process for the past ten years, and have found that they stand up mechanically and mix satisfactorily.

During the past year we have purchased twelve additional mixers.

Very truly yours,

C. C. Nesbit
Methods Department

with SIMPSON *Mix-Muller*s!

PRECISION GRINDING WHEEL COMPANY, Inc.
9301 TORRESDALE AVENUE
PHILADELPHIA 36, PA.

National Engineering Co.
549 W. Washington Blvd.
Chicago, Illinois

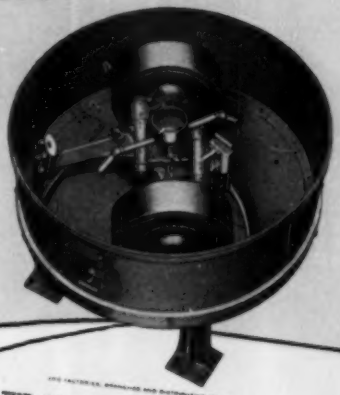
Gentlemen:

We have been using a Simpson Intensive Mixer Number 2 since June 1945 for our grinding wheel mixes. This machine has proven to be very satisfactory. The mixes have been very uniform and maintenance has been at a minimum.

Grinding wheel mixes are, of course, very abrasive, and we have been extremely well pleased with the way the muller, plows and pan have stood up under this condition.

Yours truly,
PRECISION GRINDING WHEEL CO., INC.
C. M. Fisher
Plant Engineer

The Simpson Mix-Muller installation at the J. R. Watkins Company plant is another vote of confidence for the ability of these modern units to handle fast, uniform blending for a wide variety of materials.



This is the type of Simpson Mix-Muller installation at the Precision Grinding Wheel plant. Note the enclosed drive, dust hood and National Bucket Loader for continuous, fast mixing.

THE J.R. WATKINS COMPANY
EXTRACTS SPICES SOAPS MEDICINES
PERFUMES COSMETICS
WINONA, MINNESOTA, U.S.A.

National Engineering Company
549 West Washington Blvd.
Chicago, Illinois

Gentlemen:

We are very much pleased with the engineering and laboratory work which your company recently completed for us. We are confident from tests conducted that the equipment recommended will save us considerable labor and give us a more uniform product than we previously had.

We heartily recommend this equipment where a fast and uniform blending operation is desired.

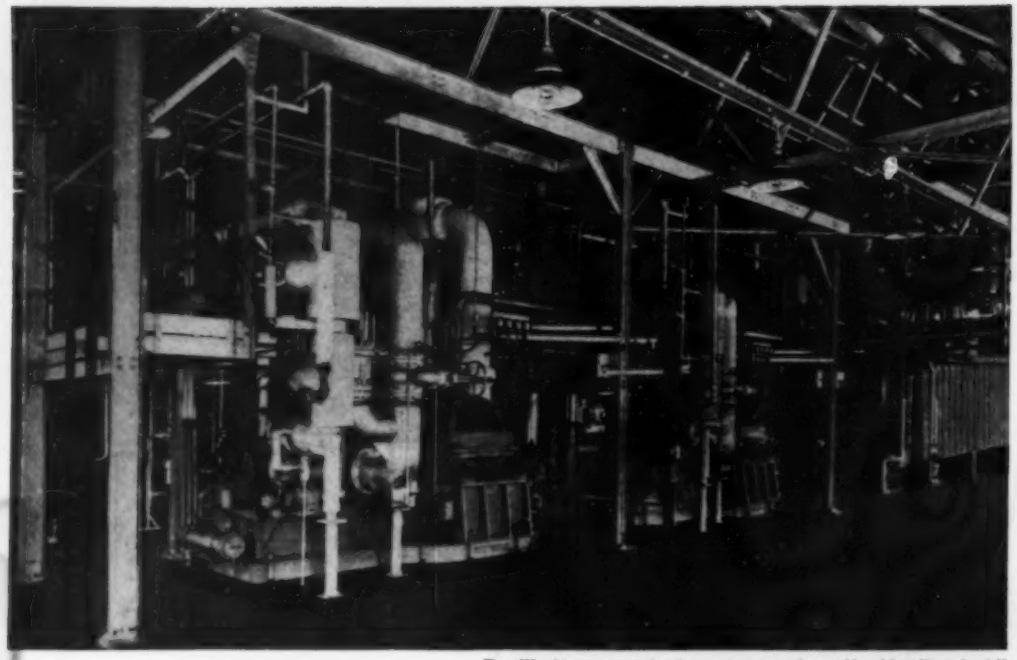
Very truly yours,
THE J. R. WATKINS COMPANY
General Supt.

WHEREVER you find Simpson Mix-Mullers handling dry, semi-dry or pasty materials, you'll find satisfied users . . . users who have found that you just can't beat the uniformly high product quality, increased mixing speed, greater production, and the lower production and maintenance costs made possible through the Simpson *intensive* mulling principle of *controlled* mixing.

These time and money-saving features of Simpson Mix-Mullers are not just idle claims . . . they have all been job-tested and proved in solving hundreds of tough chemical process mixing problems.

Let our engineers tackle *your* mixing problems. *Write for further details, or send for a copy of our current chemical process catalog.*

SIMPSON *Mix-Muller*® Division



Two Worthington centrifugal compressors, each capable of handling the full 380-ton load; at right, one of the three Worthington chilling machines.

How Socony-Vacuum Gives Wax the Cold Shoulder

For the new addition to its Paulsboro refinery, Socony-Vacuum and its process engineers and constructors, E. B. Badger & Sons Co., found the *right* chilling equipment in Worthington's complete line.

Here's how this modern plant meets the 380-ton refrigeration load required by its solvent dewaxing process.

Plant propane is alternately condensed and vaporized in a closed cycle. The liquid propane, boiling at a low pressure and a constant temperature of minus 25F, surrounds the tubes in the Worthington inclined chiller through which the wax-bearing mixture is pumped.

Propane vapor, released in the chiller, is withdrawn to be compressed, with two liquid intercooling stages, from suction conditions of about 8 psig to a condenser pressure of 215 psig.

The compressors are four-stage Worthington centrifugal compressors. They are driven by 8420 rpm Worthington steam turbines which take steam from the plant mains at about 400 psig and exhaust at 40 psig back pressure to be used for heating purposes in other parts of the solvent recovery process.

Important installations such as this one are most likely to include Worthington refrigeration, because Worthington offers complete cycles for petroleum, chemical and petro-chemical applications, including centrifugal charge gas compressors for high pressure, condensers, coolers and exchangers.

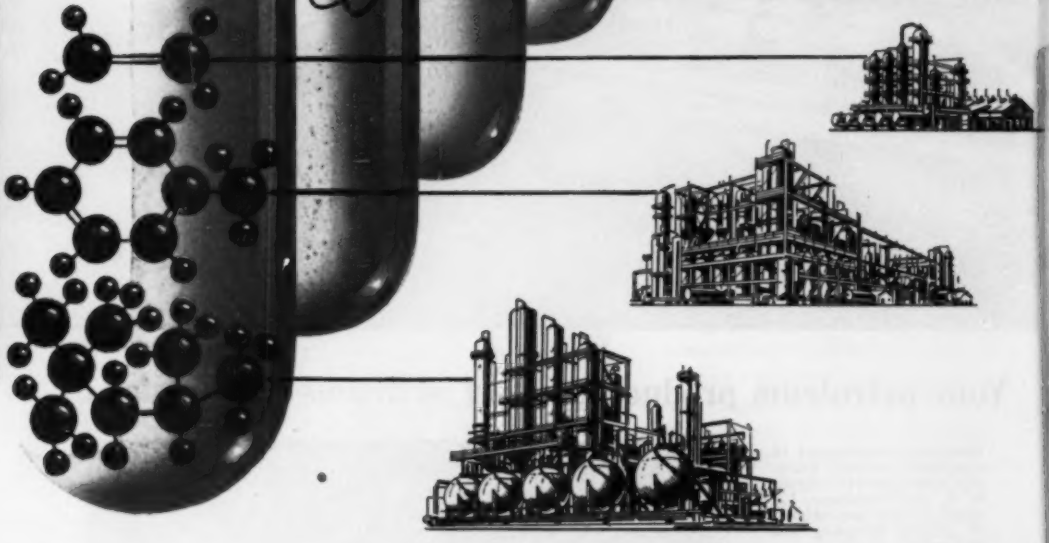
Take advantage of the *more worth in Worthington.* Write for bulletin to Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey.

A1.43

WORTHINGTON

THE ONLY COMPLETE LINE...ALWAYS THE CORRECT RECOMMENDATION

Producing the UNKNOWN



Badger can be of great assistance to you in speeding development of new products or processes from your laboratory to full commercial production.

Badger's reservoir of engineering knowledge and experience can save you months in process investigation.

Badger planning includes consideration of long range factors such as need for expansion and the effect of possible technical and economic developments.

When Badger handles all details of engineering, procurement and construction you eliminate the necessity of expanding your own organization. Badger's *single responsibility* often results in considerable savings in time and money.

When your organization must rapidly complete process facilities involving new concepts get in touch with Badger.

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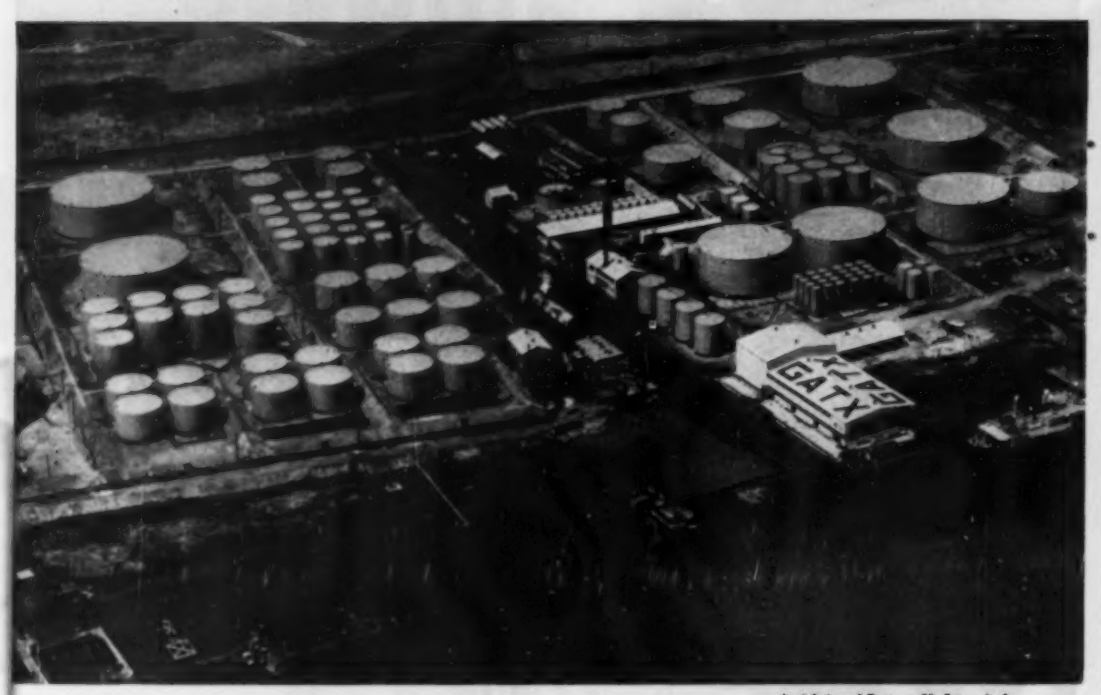


Aerial view of Carteret, N. J. terminal

Your petroleum products *packed in drums or barrels . . .*

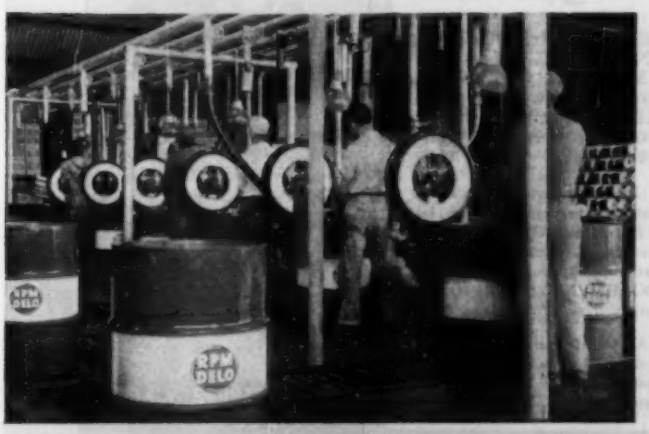
With no investment in equipment, General American customers at Carteret, N. J., and Goodhope, La. enjoy all the convenience of private barreling and drumming.

Your own product . . . blended to your specifications, can be handled in this manner . . . packed and ready for quick distribution. These two terminals also offer complete facilities for rapid canning of petroleum products in all size containers including one-quart.

NOW IT'S *FIVE* STRATEGICALLY LOCATED TERMINALS EQUIPPED TO HANDLE ANYTHING THAT FLOWS THROUGH A *PIPELINE*— Alcohol, benzol, creosote, petroleum or vegetable oil, etc.

market at lowest possible cost–

GENERAL AMERICAN opens new Chicago Tank Storage Terminal!



Make the Midwest your market! Develop the potential of this great inland industrial center. Enjoy all the advantages of your own private terminal . . . without risking capital . . . *without making any investment.*

The new terminal is ideally situated near Chicago's Clearing Industrial District at 67th and Archer on the Sanitary and Ship Canal. It's fully equipped with most modern facilities—special equipment guards against contamination of different types of liquids—protection against excessive evaporation, fire and explosion. Everything for safe, profitable storage and complete distribution at lowest cost.

As a further aid, General American Tank Storage Terminal warehouse receipts represent the highest form of collateral. For financing, storage or distribution suggestions, contact your nearest General American representative.

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A Division of General American Transportation Corporation

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WORLD'S LARGEST PUBLIC TANK STORAGE SYSTEM

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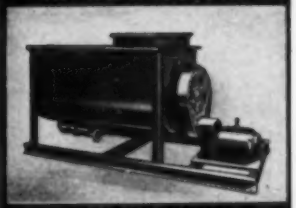
For Infinitely Greater Production Possibilities

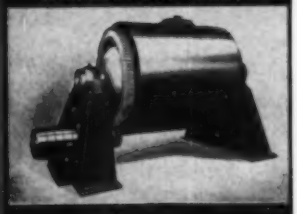
PORTABLE MIXERS

Precision Built—Direct Drive Hi-Speed, or Intermotor Slo-Speed. Electric or Air-Motor Types—Any Size, with Completely Sealed, Self-lubricated Ball Bearings.

DRY BLENDERS
From 25 to 10,000 lbs.



RIBBON MIXERS
From ¼ to 175 cu. ft.



BALL MILLS
Welded Steel Construction

SIDE ENTERING MIXERS
½ to 30 H.P.

"International" Complete Processing Systems

To the Chemical and allied Industries, INTERNATIONAL ENGINEERING offers the most complete line of Modern PROCESSING EQUIPMENT ever presented—with a completely INTEGRATED and perfectly BALANCED SYSTEM of operation, for the highest efficiency and lowest costs.

When you're making improvements, building a new plant, or expanding your present facilities, be sure to check with INTERNATIONAL for the latest Engineering Developments in improved EQUIPMENT for the correct and most economical BLENDING, TREATING, MIXING and GRINDING of Chemical components.

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DISTRICT REPRESENTATIVES IN PRINCIPAL CITIES

Memo from the Editor **John R. Callaham**

How CE is Turned Out for . . .

. . . easier, more pleasant, more profitable reading.
. . . accurate, logical and coherent presentation.

Some 3,117 of you have now returned those questionnaires I told you about in April last year. Your answers are helping us turn out a CE that's slanted to your needs.

Some of you add footnotes to your ballots and comment—among other things—on how we've improved CE's appearance and readability. Here's a little of the background of how come.

Several years ago we were introduced to what's known in the jargon as "reader traffic" surveys. These have taught us how people—you and I—look at and read magazines. We've had continuing professional guidance, too, in this direction. That's why we've had the improvement that you're commenting on.

All my associates here at *Chemical Engineering* think along these lines when they work on articles, reports and departments. The whole thing is a cooperative effort. But a lot of the responsibility falls to a guy I'd like you to meet—Les Pope, our managing editor.

Les has his editorial weather eye always cocked on one objective: how to make your reading of this magazine easier, more pleasant, more profitable.

His big job is to see that we present material so that you can grasp what it's about in the shortest possible time. Why? Well, he knows you're busy. He knows you want ideas properly crystallized so that you can evaluate them quickly. He knows you don't want to be entangled in an exasperating mess of a few good ideas co-precipitated with what he calls "a floc of excess verbiage."

One part of this job is layout—the display of the "meat" of an article—that ties pictures, captions, titles and "blurb" all into a unified message. These should work together to tell you in about 10 seconds what the article is all about. Then you can decide at once whether you want to read or to skip.

We all know that layout should be functional, neat, unified, to the point. But sometimes we trip. That's where Les steps in. (Most often it's a simple matter of explaining and compromise. But once in a while they make me the judge between two good—and strongly held — opinions. That's tough. The solution usually then turns out to be a composite product of the three of us.)

Appearance—that's part of Les' job, too. In this he's ably assisted by the talents of Margaret Redfield whom you've already met (Memo, May 1950).

What an article says is important, too. A lot more important than what it looks like. Here, again, Les is on his toes—and in our hair. He has read, for instance, practically every word of the 109.5 editorial pages in the issue you're now holding. At his "This isn't clear, that doesn't convey the true meaning," each of us has to come forth with changes that'll make for greater clarity and accuracy.

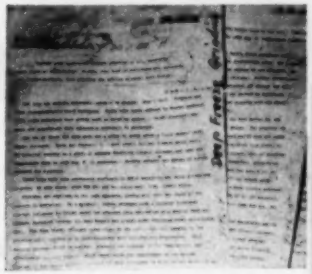
Consistency with accuracy: that's always Les' aim. He sees to it that commas are in the right places, words in the right order, the same word spelled the same way throughout. Les would be the first to say that we're far from consistent and sometimes grammatically awkward. But we'd be much less consistent, much more grammatically gauche, without his tuscan red pencil.

Again, what's said is more important to you than how it's said. Here we lean heavily on our authors and the chemical engineering training and experience of all our editors. But Les, in his job as final reader of all copy, has often picked up an error of fact that escaped everyone else.

This managing editor has other duties, too. He's the one in charge of our mechanical problems. For example, he sees to it that the magazine has covers, mails on time and—a constant problem—that all pages and engravings are right-side up!

Les is cut out to be a managing editor. From his father, professor and head of the department of architecture at Pratt Institute, he learned the value of exactness. From Columbia University, he got his degree in chemical engineering. From almost 13 years of editorial experience—first with *Scientific American* and since 1939 with us—Les has learned well the professional tricks of putting out a technical publication.

EDITOR Pope red pencils this . . .



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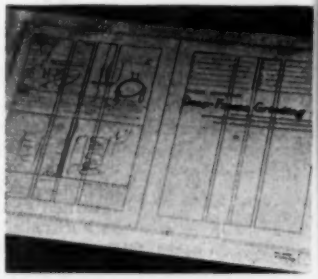

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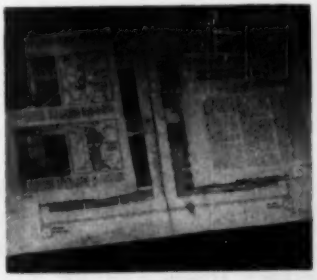

ARTICLE looks like p. 106 ➡

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Every day, companies from coast to coast that use steel in chemical processes are being expertly served by the network of thirteen great Ryerson plants. Each plant has large and diversified stocks. Each plant is equipped to accurately cut or otherwise prepare your steel to exact specifications.

Under the Ryerson simplified purchasing system you save time. One order and one invoice quickly cover a whole group of steel requirements. Specialists, whose recommendations are backed by more than a century of Ryerson steel-service experience, will gladly assist you on any steel problem.

Because of the national emergency steel shortages are inevitable. But it is possible that many of your requirements may be among the carbon, stainless and alloy steels we have on hand for quick shipment. So for any kind of steel—anytime—contact your nearby Ryerson plant. You can be sure we'll do our level best to take care of you.

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TUBING — Seamless & welded mechanical & boiler.
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SIDNEY D. KIRKPATRICK, Editorial Director JOHN R. CALLAHAM, Editor

Chemical Engineering
WITH CHEMICAL & METALLURGICAL ENGINEERING

JUNE 1951

Why Invest in Dynamic Research?

Whatever it is that chemical industry can best do for itself and for humanity lies in the province of research. We can accomplish most when we direct our resources to the creative processes of investigation, evaluation and application of new knowledge. That we have long realized this is evident from the men and money our industry has put into its research programs. But only recently have we applied ourselves to the broader aspects of research. Only now are we beginning to see the national implications of our investments in human and mechanical energy.

Energy, of course, may be either potential or kinetic. In turn, each type may also be subdivided into internal and external. The potential energies of our research system are largely internal, resulting from human resources, from inherent imagination and technical competence. The kinetics of research result from the motion and momentum of the system and the mechanical features of our facilities.

These thoughts of industrial research in terms of energy and its equivalents had their origin in a recent visit to Du Pont's new $30 million research center at Wilmington. As we listened to the dedicatory addresses, we were reminded that laboratories are indeed great storehouses of energy. Chemical Director Bolton and Chief Engineer Read showed us how human energies and resourcefulness are multipiled many times by the heavy investment in modern facilities and equipment. No longer is the researcher solely dependent on his own efforts. He is backed by experienced specialists with apparatus and techniques not previously available. Du Pont's engineering department has not only contributed much to mechanical design and laboratory construction, but has applied its knowledge of production processes in the pilot plants and other research facilities.

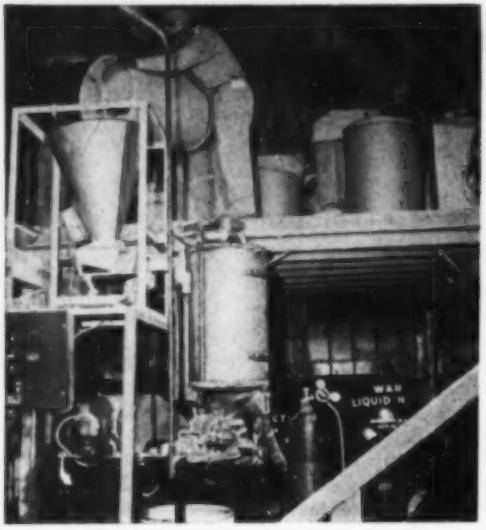
President Greenewalt's evident concern is over the future supply of young scientists and engineers whom he counts as his company's "irreplaceable" resource. "These men and women are an asset which, unlike buildings and equipment, will never appear on the company's balance sheet, but which is nevertheless our most promising hope of the future." For the training of these investigators, industry must, of course, rely primarily upon the universities, "since it is in that atmosphere that the search for basic truth and new knowledge can flourish most effectively." All the more reason, therefore, that our colleges should not dissipate their energies in applied rather than fundamental research.

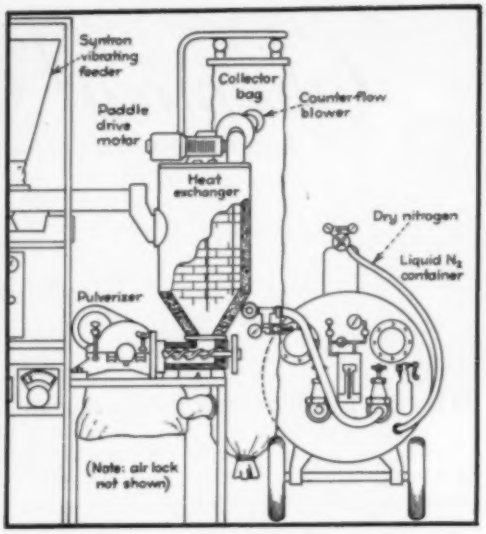
It remained for Chemist-Educator Conant to view this teamwork of scientists, inventors and executives from the perspective of the nation. Despite pressures driving academic men "down the road of programmatic research," he thinks "the American people will be wise enough to support the uncommitted investigator in science." Likewise, the modern descendants of James Watt, the inventor, and Matthew Boulton, his executive sponsor, are key men in advancing science and technology in an industrial democracy. We must do all we can to support and encourage all three groups, at the same time avoiding the regimentation by government as carried to its extreme in the fusion of science and society in the Soviet Union.

Barring a global war, which Dr. Conant believes is by no means inevitable, he predicts that younger scientists will live to see the outcome of competition between two rival science systems—one exemplified by American industry and American universities, and the other by the Soviet system in which the very premises of freedom are denied and ridiculed. Thus it is that our belief in and support of research may ultimately decide our destiny as a nation.

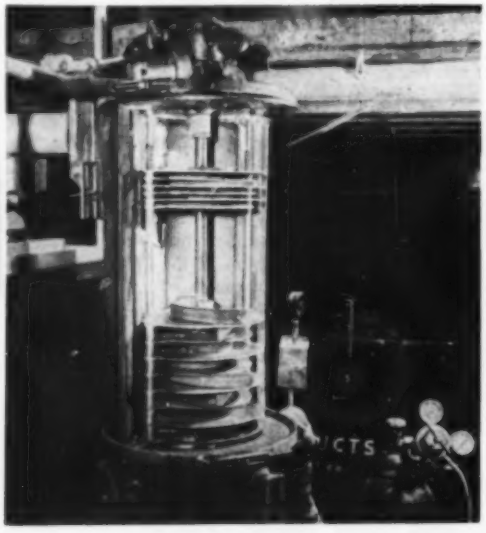
Sidney D. Kirkpatrick

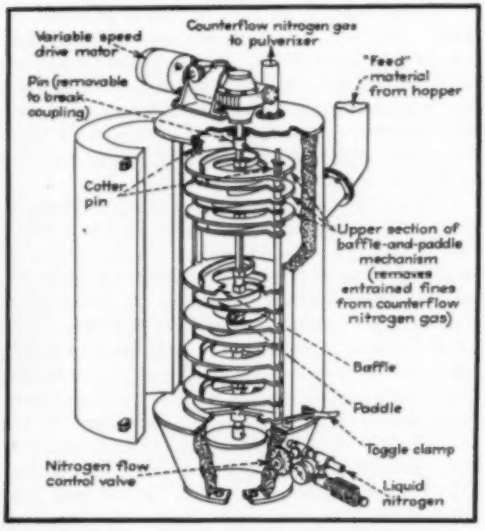
HOW deep-freeze grinding works





OVER-ALL view of liquid nitrogen set-up at Importers' Service Co. which is using the process for grinding hydrogenated lards, hard waxes, oily spices and similar materials. Worker is feeding coarse material into Syntron (vibrating) hopper from which it goes to the top of the stainless steel liquid nitrogen heat exchanger (drum-like object). From the bottom of the heat exchanger, the refrigerated coarse material drops into the high-speed hammer mill located directly below. This pulverizer at 10,000 rpm. grinds the material, drops it into the drum below. Cylinder of dry nitrogen shown, is used to supply the necessary pressure to force liquid nitrogen (from mobile carrier in background) to the heat exchanger.





HEART of the process is the heat exchanger, enclosed by a double-wall shell insulated with Fiberglas to reduce heat leakage into chamber. Coarse material comes in at the upper left, drops on the widely-spaced baffles located in the lower half of the exchanger. The gage at the right indicates the liquid nitrogen pressure and indirectly its rate of flow into the exchanger. Flow is controlled by the globe valve just below the gage-bellows on the pipeline. Upper set of baffles serve as fines collectors. A spray of liquid N_2 enters the bottom of the exchanger, cools by direct contact heat transfer. After evaporation, N_2 passes up the exchanger, pre-cools material which is now going through the baffles.

WHERE can you use liquid nitrogen?

1. Where materials are too tough to grind by conventional methods.
2. Where materials have low melting points, normally overheat and prevent continuous grinding, or grinding results in torn rather than sharply defined particles.
3. Where higher pulverizing rates or continuous pulverization is desired without increasing plant facilities.
4. Where an inert atmosphere is required for product purity, explosives etc.
5. Where low mill temperatures will prevent loss of volatiles.

WHAT materials can you use it on?

1. On plastics such as saran, vinyls, styrenes, ultra-fine acrylates such as for dentures, Buna N.
2. On insecticides such as DDT and toxaphene.
3. On pharmaceuticals, primarily glandular products and biologicals such as penicillin and sulfa drugs.
4. On foodstuffs such as mace and nutmeg, coffee, agar-agar and the like.
5. On any substance containing Vitamin A or carotene, or any other substance very sensitive to oxidation.

UNIQUE OPERATION:

Grinding With Liquid N_2

Whether your operations include grinding or not, here's an ingenious piece of engineering: cooling very hard or heat-sensitive materials with liquid nitrogen, then grinding the brittle material more easily.

Not long ago certain materials couldn't be ground: they'd melt. Vitamins and other pharmaceuticals would decompose. Foods like lards refused to become powdered. Still other materials were pretty hard on grinding cycles—tough plastics like saran and polystyrene were especially difficult to pulverize.

Now all of these and many more are a cinch to grind after a "cold shower" with liquid nitrogen. Linde Air Products Co. takes credit for the process which cools the material rapidly to a point of maximum fragility (liquid nitrogen can take the temperature down to −320 deg. F. if necessary), thereby reduces the amount of energy required for fracture.

Linde says that some previously difficult to grind materials are being pulverized at rates, in some cases, over 700 lb. per hr. using small 5-hp. hammer mills.

Pictures and captions on the page opposite, pretty well tell the story of the process in operation. In a nutshell, liquid nitrogen from a portable insulated storage container is forced under low pressure into the bottom of a special heat exchanger installed between the feed hopper and a high speed stainless steel pulverizing mill. The fine liquid nitrogen spray plays on the coarse material passing to the grinding mill, cooling it by direct-contact heat transfer and evaporation. Cold gaseous nitrogen which is evolved, precools the material in the feed hopper, and effectively excludes room air which could raise the temperature of the system. Passage of the coarse material through the heat exchanger is aided by the motor-driven rotating paddles which force the material from one baffle down to the next. Thus far it has not been necessary to take advantage of the −320 deg. F. temperature possible with liquid nitrogen.

Right now the process isn't all clockwork, but Bell's first telephone wasn't equipped with a dial system either. Weighing on the disadvantage side: the process is limited to costly materials that justify the added expense of the nitrogen, the stainless steel equipment, and the added maintenance problems. Another obvious problem is evaporation of costly nitrogen gas in transportation, storage and use. Following this argument, your proximity to sources of the coolant is important. If you would have to freight it, chances are that costs and shipping problems would rule the process out for you—at least for the present.

Costs vary over a wide scale. For foods, (probably the best outlet for the technique), the increment is 2-12 c. per lb. of material ground. For plastics the best guess is to find out how many pounds of liquid nitrogen you'll need per pound of grind, find out how much the refrigerant will cost delivered to your plant, in the quantities you'll need, allow a factor for evaporation losses, then if grinding efficiency justifies added cost, you're in business. Some examples: pulverizing of granular ethyl cellulose takes 1 lb. of the liquid nitrogen for each 9 lb. of final grind. A tougher or more resilient material like one of the vinyls might take 5 lb. of the refrigerant per pound of grind and, again, a more friable material like DDT may take only 1 lb. of liquid nitrogen for every 10 to 20 lb. of material. At least one processor has experimented with cheaper refrigerants like dry ice, but found them to be unsatisfactory.

In food processing the process is especially desirable because foodstuffs can be ground without loss of natural aromas, oils, essences, moisture and vitamin content. Importers Service Corp., a custom grinding firm, has successfully licked several grinding problems of foodstuffs, among them the grinding problems of spice blending, traditional bane of food processors. This firm has found that spices like nutmeg can be production ground at much more satisfactory rates than had had previously been possible using older conventional methods of grinding. The new technique has considerably increased the output of these foodstuffs.

Cost Estimating Simplified

Don't wait until that new plant design is ready. Estimate your investment and manufacturing costs now. Here's how to do it for products in any stage of development—pilot plant or pipe dream.

CECIL H. CHILTON

The telephone rings in the office of the research engineer. "Say, Charlie," comes the voice of a research group leader, "one of the boys in our group has been doing some scouting work in organometallic compounds. He's got one that looks like it might be good, durable flameproofing agent for textiles. How about dashing off an order-of-magnitude estimate as to its probable cost?"

"Say, Charlie," goes another phone conversation several months later, "remember that estimate you made on a flameproofing agent? We're having a meeting with Doc next Tuesday to discuss plans for more process development work, and you're to bring along an up-to-date cost estimate. You already have most of the available laboratory data right there in your copies of the monthly progress reports."

Charlie, our mythical research engineer, keeps fairly busy answering such requests. His job, however, is anything but mythical; he, and hundreds like him throughout the chemical industry, provide management with economic evaluations of proposed new products and processes as early in the course of research and development as possible. He turns out in days, sometimes hours, estimates that would ordinarily take weeks to prepare in engineering detail. How does he do it?

Of fundamental importance is the basic philosophy upon which he operates. He is willing to sacrifice a high degree of accuracy in order to save time and eliminate the need for outside assistance.

The secret of Charlie's success, you see, lies in his ability to develop estimating methods and factors which save time, cut corners, and require a minimum of process data. You may find some of his ideas generally applicable; others may be used only occasionally. As you gain experience you will probably develop methods which better suit your own requirements.

ASSOCIATE EDITOR CHILTON drew *from several years' cost estimating experience with Du Pont in preparation of this article.*

Your first step in developing cost estimating skill is to familiarize yourself with the cost accounting methods used by your own company. If your accountant classifies chief operators as "labor" and non-operating foremen as "supervision," then your estimates should be made on that basis. If the company's selling prices include delivery charges for certain products, then your estimates for the same or similar products should also allow for delivery costs. The chart on the opposite page, illustrating a typical cost and price structure for a chemical product, will be followed throughout this discussion. You might have to modify it, however, for your own purposes.

ESTIMATING PLANT COST

An estimate of the fixed investment, or capital cost, of the proposed plant is essential to any study of process economics. In most cases, this part of the job requires the greatest amount of your time. Plant cost can be estimated from the cost of the major process equipment elements. Published articles have described various estimating methods by which you can get approximate figures for plant cost without going into such details as piping arrangement and building design. The method outlined in *Chemical Engineering*, June 1949, pp. 97-106, is generally applicable where the process flowsheet has been worked out but other details are lacking.

Frequently you just don't have enough time or process data to permit you to synthesize a plant cost. If you know the actual cost of a plant similar to the one under consideration, you can estimate the cost of the new one by correcting the known cost for changes in the construction cost index and, if necessary, for major differences in size. The former correction is simple enough to make. It requires that you multiply the known cost by a suitable current or anticipated cost index and divide by the value of the index current when the reported cost was estimated or incurred.

The principal difficulty with this method is that process plant costs do not as a rule vary linearly with the size of the plant. A survey of plant cost data (see *Chemical Engineering*, April 1950, pp. 112-114) found that cost of the typical process plant varies with size by about the 0.6 power. If you want to estimate the cost of a new plant twice as large as another plant of known cost, for example, you can figure that the new plant will cost 2^m times as much, where the exponent m is normally about 0.6. The exponent may approach 1.0, however, if multiple units are to be used.

Data on plant costs were published last month in *Chemical Engineering* (pp. 164-165) in the form of charts showing the cost per annual ton of over 125 different process plants, corrected to 1950 index levels. These charts show only a single cost for each type of plant, independent of size.

Estimating by analogy is easy if you are working on an established commodity, difficult if you are dealing with a new product. Although this method is somewhat risky, in many cases the result is just as accurate as that obtained by a synthetic estimate.

ESTIMATING MANUFACTURING COSTS

Raw Materials—Estimation of the cost of the product begins logically with consideration of the raw materials or ingredients. You can calculate quantities of raw materials required per unit of product from material balances. Laboratory yield figures are not always duplicated in the plant; they should be tempered by experience. Actual price quotations from prospective suppliers are preferable to published market prices.

If the ingredients for the new process are to be obtained from another operation within the company, you must decide just how to charge them to your process. Where these materials are already being sold to others, you can take their transfer value as the market price less selling and other related expenses. A more fundamental and universal approach is to charge them in at their factory cost, allowing for proper allocations of associated plant investment and general expenses in subsequent calculations.

You should consider the form in

which raw materials will be purchased. Although bulk shipments are cheaper than bag and drum shipments, they require additional handling and storage facilities and a greater inventory. So don't base your estimate on bulk prices unless you really expect to purchase in quantity.

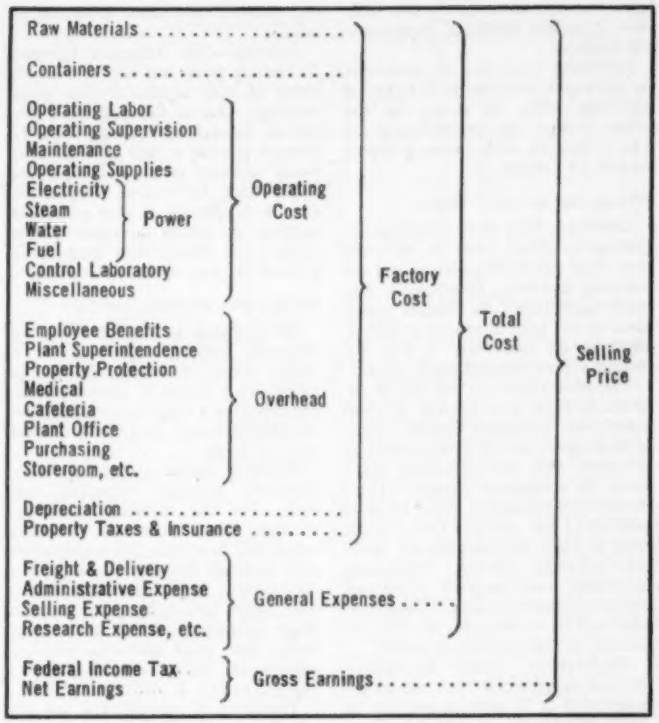
Another thing to remember is freight on raw materials. Where prices are quoted on an fob. basis, your actual delivered cost must allow for freight from the supplier's plant.

Containers—The form of packaging, such as paper bags, non-returnable steel drums, tank cars, etc., determines the container cost. A few common cost figures may be of interest: Paper bags for packaging dry chemicals run about 15 c. per 100 lb. of product. Non-returnable steel drums cost about 10 c. per gal. of capacity. Returnable glass carboys can be charged in at about 50 c. per trip. For bulk shipments, package cost is omitted, except where special types of cars must be leased. Rental of a rubber-lined tank car, for example, will cost about $75 per mo.; for a chlorine tank car, about $150 per mo.

Operating Labor—Although this is an important item, it is rather difficult to estimate unless you have extensive plant records and experience. If the flowsheet is in good shape and you can visualize a plant layout, you may make a reasonably good guess as to the number of men required per shift or per day. For a check against this estimate or as a basis for first guesses, you may refer to a chart on man-hours of direct labor per ton of various products which was published in *Chemical Engineering*, Feb. 1951, p. 151.

As to hourly wage rates, the best source of information is your own payroll department. The current average level is about $1.60 to $2 per hr. for operating labor, the choice within this range depending on whether unskilled or skilled workers predominate.

Operating Supervision—Estimation of the number of foremen, supervisors, and technicians, and their probable salaries is the most direct approach. Or, supervision may be figured as a percentage of operating labor. The proper percentage to use will depend, of course, upon your definition of supervision, the technical complexity of the process, and the design and layout of the plant. Suppose we assume that operating supervision will exclude not only chief operators and working foremen but also top level plant superintendence. On this basis a supervision factor of 10 percent may be sufficient for a process involving simple operations and little automatic control.



Supervision as high as 50 percent of labor is not out of the question however for a highly instrumented technically complex process. A factor of 15 to 30 percent would be suitable for the average chemical process.

Maintenance—Except for detailed estimates, maintenance is usually figured as an annual percentage of fixed investment. It may be as low as 2 percent where corrosion and wear are at a minimum, or as high as 10 to 15 percent where corrosion, extreme temperature, and abrasion are experienced. If you can get the necessary data, check the ratio of maintenance cost to fixed investment for processes in your own plant. Don't forget to correct the fixed investment for the change in cost index between the time of plant construction and the year in which the maintenance money was spent. A good average for normal chemical operations would be 4 to 8 percent; for severe conditions use up to 12 percent. Labor constitutes about 50 to 65 percent of maintenance cost.

Operating Supplies—Major supply items should be listed separately at their estimated costs. Miscellaneous expenses, such as gloves, stationery, flashlights, wiping rags, and grease are more easily estimated as a function of other cost items, such as operating labor or maintenance. The writer has found that correlation on the basis of operating labor is preferable. For a number of processes, operating supplies varied from 5 to 20 percent of labor, averaging about 10 percent.

Power—You can estimate process energy requirements from flowsheet and energy balance data. For preliminary estimates, rigorous calculation of motor sizes, dryer efficiencies, and similar details is unnecessary. Approximate figures for unit consumption of electricity, steam, and water for a number of processes were published in *Chemical Engineering*, March 1951, p. 115, and April 1951, pp. 110-111.

The best source of information on utilities prices is your own power engineer or accounting department. Generally speaking, unit prices will fall within the following ranges:

Electricity: 0.5 to 1.5 c. per kwh.
Steam: 35 c. to $1 per 1,000 lb.
Water: 1.0 to 15 c. per 1,000 gal.

Control Laboratory—Like operating supervision, this item can be either approached directly or tied to some more basic cost. If test procedures have been worked out, you can estimate the probable hours of analyst's time and

figure the cost at an hourly rate sufficient to include laboratory supervision and supplies.

Laboratory costs can be estimated for high-spot purposes as a factor of operating labor. A survey by the writer showed an extreme range of 5 to 35 percent, with a close grouping around 20 percent.

ESTIMATING INDIRECT COSTS

Overhead—The best procedure regarding overhead costs is to study your own plant's experience and accounting methods. Overhead is normally apportioned to various operations on the basis of operating payroll, although the basis may or may not include supervision and repair labor.

The actual factor to use will be determined from your analysis of plant experience. Employee benefits, which include social security taxes, vacations, pensions, etc., are sometimes segregated in a separate account. These items alone amount to about 15 to 20 percent of the payroll. Other items, such as plant superintendence, medical, cafeteria, clerical, purchasing, storeroom, and property protection, will loom somewhat larger. Total overhead will be on the order of 50 to 100 percent of the productive payroll.

Depreciation, Taxes, Insurance—Normal depreciation rates are in the range of 5 to 10 percent per year on plant investment. Emergency plants being built today might be figured on rates as high as 20 percent. Property taxes and insurance involve an additional 1 to 3 percent.

Freight and Delivery—If your estimate is on an fob. basis, you can neglect freight. If on a delivered basis, however, suitable freight rates must be developed.

Administrative Expense—Top management incurs an expense over and above that directly chargeable to manufacturing costs. The magnitude of this expense and the methods by which it is apportioned cannot be generalized—it is mentioned here primarily to make sure it is not overlooked in preparing cost estimates. In the absence of specific data, you can include administrative expense at about 2 percent on the sales dollar.

Selling Expense—The safest way to estimate selling expense is to check your sales department's experience. For preliminary estimates on industrial chemicals, you can use a factor of 3 to 10 percent on the sales dollar.

Research Expense—Charges for research and technical expense may be determined from your research budget. As an approximation, you can estimate research expense as a factor on the sales dollar. For the chemical industry, research runs about 3 percent of sales.

Earnings—The difference between the selling price and the sum of all items of cost represents your gross earnings. Out of this you must pay federal income taxes of at least 47 percent, possibly as high as 77 percent, under existing laws. Although the upper limit for over-all corporation taxes is 62 percent, if your additional earnings are within the excess profits bracket you should show taxes at 77 percent in your economic evaluation.

ESTIMATING WORKING CAPITAL

Be sure your estimate provides for adequate working capital. Here is where many economic studies go astray. It is unsafe to guess at working capital as a single factor of sales or investment unless you are sure of what you are doing.

Working capital is made up of inventories, accounts receivable, and cash. For raw materials inventory, estimate the maximum quantities which will be stored. For readily available materials this may be only a few days' supply. Imported materials, however, might have to be stored in much larger quantities, such as entire shiploads. For quick estimates you can assume an average of one month's supply, valued at delivered prices.

Inventory of semi-finished and finished products will depend upon processing sequences, testing routines, and market conditions. Some commodities are steady movers, others are seasonal. Some require long testing periods, others can be cleared for immediate shipment. In the absence of specific information as to requirements, one month's production, valued at estimated total cost, should be enough.

The amount of working capital required for accounts receivable will depend upon the credit terms allowed your customers. For preliminary estimates you can allow one month's sales, valued at selling price. The supply of cash needed to do business is best set by the financial officers of the company; for quick estimates, you might assume a cash requirement equivalent to one month's total cost.

RETURN ON INVESTMENT

The attractiveness of a new manufacturing venture is largely determined by the net return which will be earned on the invested capital. The minimum rate of return which a proposed project must show to be attractive to the executive officers depends upon such questions as the riskiness of the venture and the availability of capital. Figures which have been mentioned publicly as desirable for projects in the chemical industry range upwards from 20 percent.

Your estimate might involve calculation of rate of return, working from a given selling price fixed by market conditions. In this type of study, the estimated total cost is subtracted from the selling price to obtain gross earnings. Net earnings remaining after taxes are divided by the total investment (fixed plus working capital) to get percent return. Fixed investment here must include allocated portions of power and general facilities and any other production facilities which supply intermediates at cost.

A slightly different procedure is required if you are endeavoring to predict an acceptable selling price for a new product whose competitive position has not yet been established. Here you simply add to the total cost an amount of earnings which, when shared with the tax collector, will net you an acceptable return on the investment.

SIMPLIFIED FORMULA FOR SELLING PRICE

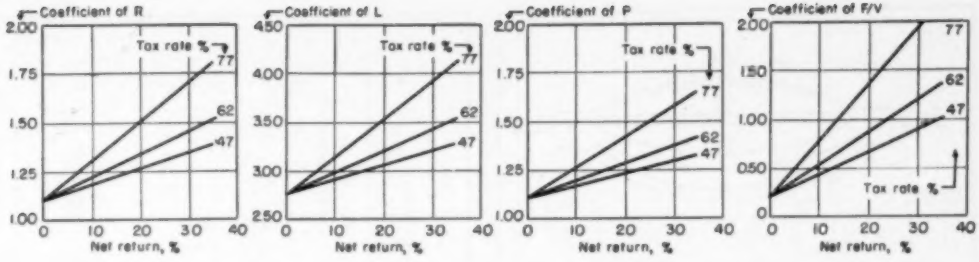
The preceding discussion has shown that many items of cost are related to others. These relations may be inherent, such as depreciation being a given percentage of fixed investment, or they may be arbitrarily defined by cost accounting methods, such as overhead to labor. Still other functions have been found by experience to be valid for estimating purposes. Examples are the relation of maintenance to fixed investment, operating supervision to operating labor, and selling expense to selling price. If these various relationships are carried to their ultimate fundamentals, the following equation for selling price can be derived:

$$S = \left[\frac{1 + xw + xh}{1 - v - xwv - xk}\right] R + \left[\frac{1 + xw + n + nxw}{1 - v - xwv - xk}\right] L + \left[\frac{1 + xw}{1 - v - xwv - xk}\right] P + \left[\frac{f + x + xwf}{1 - v - xwv - xk}\right] \frac{F}{V}$$

By substituting in this equation a suitable set of numerical factors, selling price can be expressed as a rather simple formula:

$$S = 1.34\,R + 3.20\,L + 1.29\,P + 0.86\,F/V$$

where S = selling price per unit of product; R = cost of raw materials per unit of product; L = cost of operating labor per unit of product; P = cost of containers, power, freight, and miscellaneous per unit of product; F = fixed plant investment; V = annual units of production.



The numerical relationships used in this equation are as follows:

Operating supervision = 25 percent of operating labor.
Maintenance = 6 percent per yr. of fixed investment.
Maintenance labor = 60 percent of total maintenance.
Operating supplies = 10 percent of operating labor.
Works laboratory = 20 percent of operating labor.
Overhead = 75 percent of operating labor, operating supervision, and maintenance labor.
Depreciation = 8 percent per yr. of fixed investment.
Taxes and insurance = 2 percent per yr. of fixed investment.
Administrative expense = 2 percent of selling price.
Selling expense = 5 percent of selling price.
Research = 3 percent of selling price.
Raw materials inventory = 1 mo. at cost of raw-materials.
Finished product and in-process inventory = 1 mo. at total cost.
Accounts receivable = 1 mo. at selling price.
Cash = 1 mo. at total cost.
Federal income tax = 62 percent of gross earnings.
Net earnings = 20 percent per yr. of total investment.

Any revisions in these factors will, of course, change the numerical multipliers in the final equation. You can grind through any desired changes quite readily by substituting different numbers in the original algebraic expression.

The particular formula derived here may not follow the accounting methods or relationships which you want to use. Maybe, for example, you figure overhead on the basis of operating labor only, or you might prefer to estimate operating supplies as a function of maintenance rather than operating labor. In any case, you can derive a similar simple expression to suit your own requirements.

VARIATION WITH TAXES AND RETURN

The two relations used above which are most subject to variation even for a given set of accounting and experience factors are net earnings and federal income tax. These two items determine the value of x in the formula, affecting the entire equation. The accompanying graphs show how the multipliers in the equation vary with tax rate and return on investment.

The simplified formula will not only assist in rapid cost estimating but will also permit a quick appraisal of the effect on selling price of changes in each contributing element. You can easily see, for example, that an increase in the cost of raw materials of 1.0 c. per lb. would require an increase in selling price of 1.34 c. per lb. if return on investment is to be maintained at 20 percent with a 62 percent tax rate.

In some economic studies you may want to know the contribution which each processing step makes to the total cost or selling price. In a comparison of processing alternatives on an over-all basis, significant differences might be lost. By breaking down the costs on a stepwise basis, you can spotlight the steps which might be changed or improved to advantage. With the new formula you can estimate R, L, P, and F/V for each step and calculate "partial" selling prices. This method of analysis is especially convenient in engineering studies where you want to balance an increased investment against a savings in labor. All you have to do is to find which is the lower, 3.20 L or 0.86 F/V (or whatever the coefficients happen to be).

The manner in which plant and equipment costs vary with size has received a great deal of study. The question often arises, "How will manufacturing costs vary with scale of operation?" Take another look at the formula. R and P will be almost independent of scale. F/V will be less for large-scale plants than for small-scale plants because of a reduced unit plant cost. The variation of L with scale of operation can be predicted only on the basis of a specific proposition. In some cases, the same operating crew can just as easily run a large plant as can run a small plant. For other operations, however, the size of crew will vary almost directly with the scale of operation. You can easily determine the way in which over-all cost will vary with scale of operation, therefore, by breaking the total cost down into the four segments of the formula and studying the contribution of each.

NOMENCLATURE

S = Selling price per unit of product.
R = Cost of raw materials per unit of product.
L = Cost of operating labor per unit of product.
P = Cost of containers, power, freight, and miscellaneous per unit of product.
F = Fixed plant investment.
V = Annual units of production.
a = Administrative expense as fraction of selling price.
b = Operating supervision as fraction of operating labor.
c = Control laboratory as fraction of operating labor.
d = Depreciation as annual fraction of fixed investment.
e = Selling expense as fraction of selling price.
g = Maintenance labor as fraction of total maintenance.
h = Raw materials inventory as fraction of annual raw materials cost.
j = Property taxes and insurance as annual fraction of fixed investment
k = Accounts receivable as fraction of annual sales.
m = Maintenance as annual fraction of fixed investment.
o = Overhead as fraction of operating labor, operating supervision, and maintenance labor.
p = Net earnings as annual fraction of total investment.
r = Research expense as fraction of selling price.
s = Operating supplies as fraction of operating labor.
t = Federal income tax as fraction of gross earnings.
y = Cash as fraction of annual total cost.
z = Semi-finished and finished product inventory as fraction of annual total cost.

$f = m + ogm + d + j$
$n = b + c + s + o + ob$
$v = a + e + r$
$w = y + z$
$x = p/(1 - t)$

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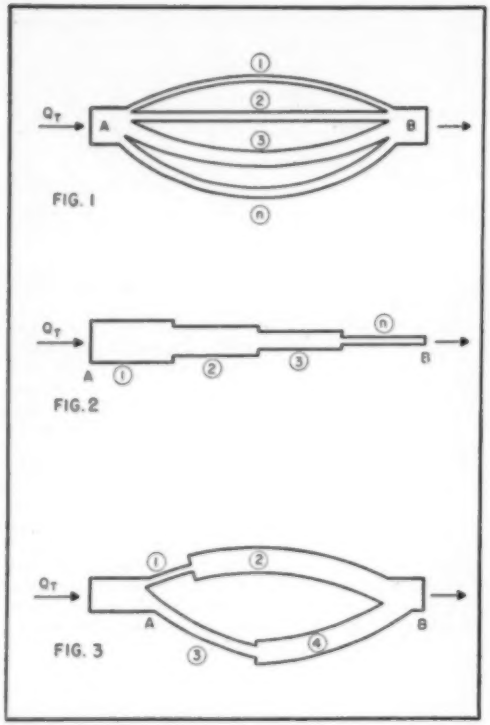
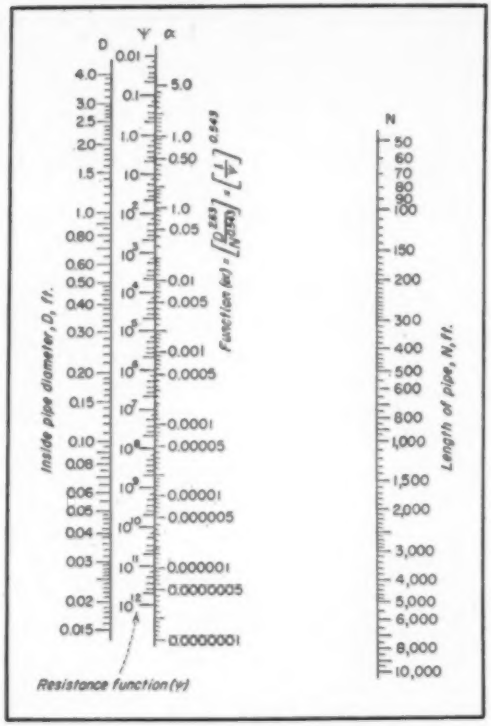


PIPING layouts for which nomographs solve flow problems.



FUNCTIONS from here are used in flow nomographs. (Fig. 4)

Cut Out Trial-and-Error

Now you have some nomographs to lick three troublesome kinds of pipeline problems: parallel, series and series-parallel flow. Trial-and-error calculations are no longer necessary.

JOHN F. HEISS and HENRY C. BRAMER

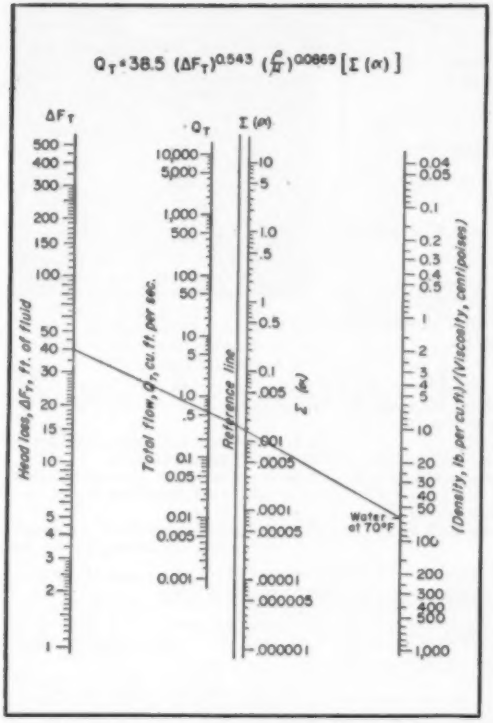
The parallel and series systems of pipelines diagrammed above find many applications in the field of chemical engineering. In the design of long transmission lines for natural gas and crude oil, as well as with the shorter pipelines present in all chemical plants, problems such as flow distribution, fractional pressure drop, pumping cost, and optimum pipe sizes and velocities are apparent.

Many adequate methods are available for the solution of these systems when a natural gas is flowing. However, for incompressible fluids, little work has been published except for water as the fluid. From the hydraulic engineer's viewpoint, a trial and error series of calculations is usually made with values of the friction factor being assumed for the various pipelines. Thereafter, these assumed values of the friction factor are checked against the Reynolds number in each pipeline until they correspond properly.

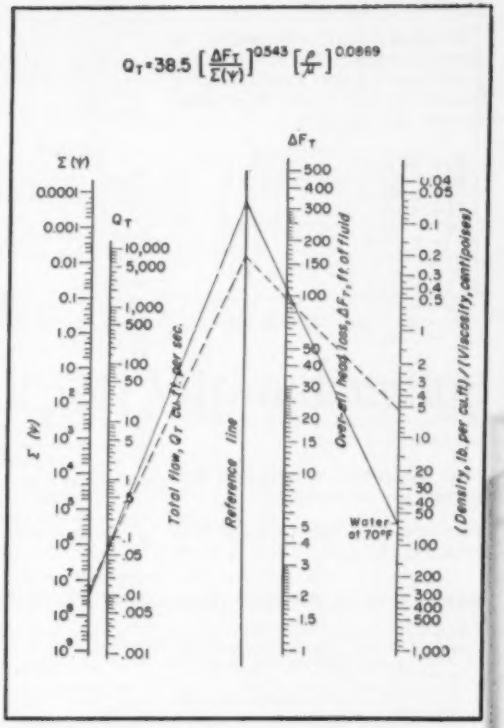
This article develops a method by means of which no trial-and-error calculations are necessary in finding the desired unknown variables. The limitations of this procedure are such that it will be applied only to liquids (incompressible fluids) which are flowing through relatively short lengths of new steel or cast iron pipe. (If the method developed is used for pipelines which have their lengths measured in miles, and their diameters in feet, the calculated pressure drops will be excessive because of slightly higher friction factors than are correct.)

Any type of expression of the form $f = aN_{Re}^{b}$ may be used in modifying the equations to be developed. In this case, however, Genereaux's equation (*Chem. & Met.*, May 1937, pp. 241-

J. F. HEISS *is a chemical engineer with Westvaco Chemical Div. and* HENRY BRAMER *is at Mellon Institute. They worked on this article while both were at the University of Pittsburgh where Bramer received his BSChE and Heiss was assistant professor of chemical engineering.*


$Q_T = 38.5\ (\Delta F_T)^{0.543}\ (\frac{\rho}{\mu})^{0.0869}\ [\Sigma\ (\alpha)]$
ΔF_T
Q_T
$\Sigma\ (\alpha)$
Head loss, ΔF_T, ft. of fluid
Total flow, Q_T, cu. ft per sec.
Reference line
α
Water at 70°F
(Density, lb. per cu.ft) / (Viscosity, centipoises)

FOR PARALLEL FLOW SYSTEMS, use this nomograph.


$Q_T = 38.5\ [\frac{\Delta F_T}{\Sigma(\gamma)}]^{0.543}\ [\frac{\rho}{\mu}]^{0.0869}$
$\Sigma\ (\gamma)$
Q_T
ΔF_T
Total flow, Q_T cu.ft. per sec.
Reference line
Over-all head loss, ΔF_T, ft. of fluid
Water at 70°F
(Density, lb. per cu.ft) / (Viscosity, centipoises)

FOR SERIES FLOW SYSTEMS, this is the one to use.

248) $f = 0.04N_{Re}^{-0.16}$ is used because of its proved reliability. Minor losses such as entrance, exit, contraction and enlargement are assumed negligible so that the total loss in head through the system will be caused by friction in straight pipelines. Points *A* and *B* will be located on a horizontal line as shown in Figs. 1, 2 and 3.

It was considered advantageous to solve the derived equations by the accompanying nomographs. Speed of solution would be increased and the arithmetic errors incurred would be decreased. However, because of the large number of cycles for the parameters α and ψ, accuracy must be sacrificed when solving for Q_T and ΔF_T. The engineer who works constantly with smaller ranges in pipe diameter and length can construct similar nomographs which will give greater accuracy than these presented.

Parallel Pipeline Example

A 6-in. I.D. conduit branches as shown in Fig. 1. The three parallel steel pipelines are of lengths and diameters as follows:

$N_1 = 125$ ft.
$D_1 = 1$ in. nom. $= 1.049$ in. I. D. $= 0.0874$ ft.
$N_2 = 325$ ft.
$D_2 = 2$ in. nom. $= 2.067$ in. I. D. $= 0.173$ ft.
$N_3 = 700$ ft.
$D_3 = 3$ in. nom. $= 3.068$ in I. D. $= 0.256$ ft.

FIND: Percentage of volumetric flow through each pipeline.

SOLUTION: Find the α functions from Fig. 4, $\alpha_1 = 0.00012$, $\alpha_2 = 0.00044$, $\alpha_3 = 0.00083$, $\Sigma(\alpha) = 0.00139$. Percentage of total volumetric flow through each pipeline is found from Eq. (12b)

$$Q_1 = 100\,\alpha_1/\Sigma(\alpha) = 8.6\%$$
$$Q_2 = 100\,\alpha_2/\Sigma(\alpha) = 31.6\%$$

FIND: Upstream pressure at point *A* if discharge at point *B* is at atmospheric pressure and 250 gpm. of water at 70 deg. F. are flowing through the 6-in. conduit.

SOLUTION: 250 gpm. $= 0.557$ cu. ft. per sec. Using the nomograph for parallel pipelines, the friction head loss is found equal to 40.0 ft. of water, equivalent to an upstream pressure of 17.3 psig.

Series Pipeline Example

A series pipeline system (Fig. 2) consists of three steel pipelines with lengths and diameters:

$N_1 = 400$ ft.
$D_1 = 1\frac{1}{2}$ in. nom. $= 1.610$ in. I. D. $= 0.134$ ft.
$N_2 = 300$ ft.
$D_2 = 1\frac{1}{4}$ in. nom. $= 1.380$ in. I. D. $= 0.115$ ft.
$N_3 = 100$ ft.
$D_3 = 1$ in. nom. $= 1.049$ in. I.D. $= 0.0874$ ft.

Flow is in the direction of *A* to *B* and pipe diameters decrease uniformly in this direction also. Over-all head loss for water flowing at 70 deg. F. is 107 ft.

FIND: Volumetric rate of flow in cubic feet per second.

SOLUTION: First find the ψ functions from Fig. 4. $\psi_1 = 7.0(10)^6$, $\psi_2 = 1.0(10)^7$, $\psi_3 = 1.5(10)^7$, $\Sigma(\psi) = 3.2(10)^7$. Using the nomograph for series pipelines, $Q_T = 0.07$ cfs.

Parallel-Series Example

A parallel-series combination of pipelines similar to that shown in Fig. 3 with branch *I*, lines 1 and 2 in series; branch *II*, lines 3 and 4 in series. Lengths and diameters:

$N_1 = 125$ ft.
$D_1 = 1$ in. nom. $= 1.049$ in. I. D. $= 0.0874$ ft.
$N_2 = 400$ ft.
$D_2 = 2$ in. nom. $= 2.067$ in. I. D. $= 0.173$ ft.
$N_3 = 300$ ft.
$D_3 = 1\frac{1}{2}$ in. nom. $= 1.610$ in. I. D. $= 0.134$ ft.
$N_4 = 600$ ft.
$D_4 = 2\frac{1}{2}$ in. nom. $= 2.469$ in. I. D. $= 0.206$ ft.

Over-all pressure drop from *A* to *B* is 37.5 psi. An oil with absolute viscosity of 10.0 centipoises, density of 56.0 lb. per cu. ft. is flowing.

FIND: Percentage of volumetric flow through parallel branch I.

SOLUTION: First find the ψ functions from Fig. 4. $\psi_1 = 1.8(10)^7$, $\psi_2 = 2.0(10)^6$ $\psi_3 = 5.0(10)^6$ $\psi_4 = 1.22(10)^6$.

$$\Psi_I = (\psi_1 + \psi_2) = 2.0(10)_7$$
$$\Psi_{II} = (\psi_3 + \psi_4) = 6.22(10)_6$$

Flow through line *I*, in percent:

$$Q_I = 100(1/\Psi_I)^{0.543}/[(1/\Psi_I)^{0.543} + (1/\Psi_{II})^{0.543}]$$
$$Q_I = 100(0.0001108)/(0.000316)$$
$$Q_I = 35.0 \text{ percent}$$

FIND: Volumetric rate of flow through parallel branch I.

SOLUTION: Over-all pressure drop at 37.5 psi. is equivalent to 96.5 ft. of oil. Using the parallel-series nomograph, $Q_I = 0.065$ cu. ft. per sec.

NOMENCLATURE

- a, b = Arbitrary constants, dimensionless.
- A = Cross-sectional area, sq. ft.
- D = Inside diameter, ft.
- D' = Inside diameter, in.
- ΔF = Loss in head because of friction, ft. of fluid.
- f = Friction factor, dimensionless.
- g = Acceleration of gravity, 32.2 (ft./sec.)/sec.
- N = Equivalent length of straight pipe, ft.
- Q = Volumetric flow rate, cu. ft./sec.
- $N_{Re} = Du\rho/\mu$ = Reynolds number, dimensionless.
- u = Average linear linear velocity, ft./sec.
- α = Conductance parameter $= D^{2.63}/N^{0.543}$ $= 1.451(10)^{-3}\,[(D')^{2.63}/N^{0.543}]$
- μ = Absolute viscosity, lb./(sec.) (ft.). (Note: If the absolute viscosity is given in centipoises it may be substituted directly into any of the equations such as (16), (25), (26), (27) or (28) by changing the value of the coefficient 20.4 to 38.5.)
- μ/ρ = Kinematic viscosity, sq. ft./sec.
- ρ = Density, lb./cu. ft.
- ψ = Resistance parameter $= N/D^{4.84}$ $= 1.672(10)^8\,[N/(D')^{4.84}]$

SUBSCRIPTS

- 1, 2, 3, n = Refers to various pipelines in parallel or series.
- I, II, N = Refers to parallel pipelines, each containing several lines in series.
- T = Refers to total volumetric flow rate, or total friction loss

DERIVATION OF THE EQUATIONS USED IN PREPARING THE PIPELINE FLOW NOMOGRAPHS

PARALLEL PIPING SYSTEMS

Case I. (Fig. 1) Given: The total rate of flow in the main conduit, and the lengths and diameters of each branch. Find: The absolute rates of flow through each loop, when the over-all pressure drop is unknown.

For the system shown in Fig. 1,

$$\Delta F_T = \Delta F_1 = \Delta F_2 = \Delta F_3 = \Delta F_n \quad (1)$$

Substituting the Fanning equation to evaluate the friction losses gives

$$\left(\frac{2fNu^2}{gD}\right)_1 = \left(\frac{2fNu^2}{gD}\right)_2 = \left(\frac{2fNu^2}{gD}\right)_3 = \left(\frac{2fNu^2}{gD}\right)_n \quad (2)$$

By Genereaux's approximate equation for turbulent flow where the Reynolds' Numbers vary from 2,000 to 20,000,000

$$f = 0.04(N_{Re})^{-0.16} \quad (3)$$

Using Eq. (2) to substitute for f in Eq. (2) yields

$$\left(\frac{N_1 u_1^{1.84}}{D_1^{1.16}}\right) = \left(\frac{N_2 u_2^{1.84}}{D_2^{1.16}}\right) = \left(\frac{N_3 u_3^{1.84}}{D_3^{1.16}}\right) = \left(\frac{N_n u_n^{1.84}}{D_n^{1.16}}\right) \quad (4)$$

On simplifying, using u_2 as the reference velocity,

$$\frac{u_1}{u_2} = \left(\frac{N_2}{N_1}\right)^{0.543}\left(\frac{D_1}{D_2}\right)^{0.65} \quad (5a)$$

$$\frac{u_3}{u_2} = \left(\frac{N_2}{N_3}\right)^{0.543}\left(\frac{D_3}{D_2}\right)^{0.65} \quad (5b)$$

$$\frac{u_n}{u_2} = \left(\frac{N_2}{N_n}\right)^{0.543}\left(\frac{D_n}{D_2}\right)^{0.65} \quad (5c)$$

By a material balance,

$$Q_T = (Q_1 + Q_2 + Q_3 + Q_n) = (u_1A_1 + u_2A_2 + u_3A_3 + u_nA_n) \quad (6)$$

For circular pipes,

$$\frac{4Q_T}{\pi} = (u_1D_1^2 + u_2D_2^2 + u_3D_3^2 + u_nD_n^2) \quad (7)$$

Substituting for the velocities in Eq. (7) by means of Eqs. (5a), (5b), and (5c) gives

$$\frac{4Q_T}{\pi} = \left[\left(\frac{N_2}{N_1}\right)^{0.543}\left(\frac{D_1}{D_2}\right)^{2.63}u_2 + u_2D_2^2 + \left(\frac{N_2}{N_3}\right)^{0.543}\left(\frac{D_3}{D_2}\right)^{2.63}u_2 + \left(\frac{N_2}{N_n}\right)^{0.543}\left(\frac{D_n}{D_2}\right)^{2.63}u_2\right] \quad (8)$$

Factoring Eq. (8) and simplifying yields

$$\frac{4Q_T}{\pi} = \left(u_2D_2^2\right)\left(\frac{N_2^{0.543}}{D_2^{2.63}}\right)\left[\Sigma\left(\frac{D^{2.63}}{N^{0.543}}\right)\right] \quad (9)$$

Rearranging, $$Q_T = Q_2\frac{\left[\Sigma\left(\frac{D^{2.63}}{N^{0.543}}\right)\right]}{\left(\frac{D_2^{2.63}}{N_2^{0.543}}\right)} \quad (10)$$

Letting $\alpha = \frac{D^{2.63}}{N^{0.543}}$,

then, $$Q_T = Q_2\frac{(\alpha_1 + \alpha_2 + \alpha_3 + \alpha_n)}{\alpha_2} \quad (11)$$

Therefore, in general,

$$Q_T = \left(Q_x\frac{[\Sigma(\alpha)]}{\alpha_x}\right) \quad (12a)$$

or the volumetric rate of flow, Q_n, through branch n of a parallel piping system may be found from Eq. (12b) as follows:

$$Q_n = Q_T\left[\frac{\alpha_n}{\Sigma(\alpha)}\right] \quad (12b)$$

Eq. (12b) definitely shows the manner in which a fractional amount of the total flow is distributed in each branch according to the ratios of the α functions.

Case II. Given: The over-all pressure drop, the lengths and diameters of each branch, and the kinematic viscosity of the flowing fluid. Find: The total volumetric rate of flow.

From Eqs. (1), (2), and (3) and considering pipeline 2 as the reference conduit, Eq. (13) is obtained

$$\Delta F_T = \left(\frac{0.08N_2}{g}\right)\left(\frac{u_2^{1.84}}{D_2^{1.16}}\right)\left(\frac{\mu_2}{\rho_2}\right)^{0.16} \quad (13)$$

Solving for u_2

$$u_2 = 26.0\left[\left(\frac{\Delta F_T}{N_2}\right)^{0.543}\left(D_2^{0.63}\right)\left(\frac{\rho_2}{\mu_2}\right)^{0.087}\right] \quad (14)$$

But,

$$Q_2 = u_2A_2 = u_2\frac{(\pi D_2^2)}{4} \quad (15)$$

From the previous derivation it has been shown that

$$Q_T = Q_2\left[\frac{\Sigma(\alpha)}{\alpha_2}\right] \quad (12a)$$

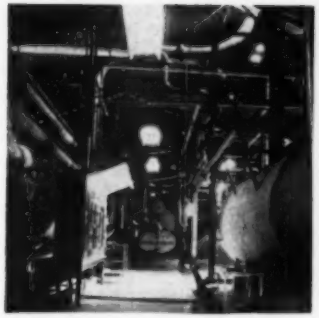
Substituting for Q_2 in Eq. (12a) by means of Eqs. (14) and (15) gives

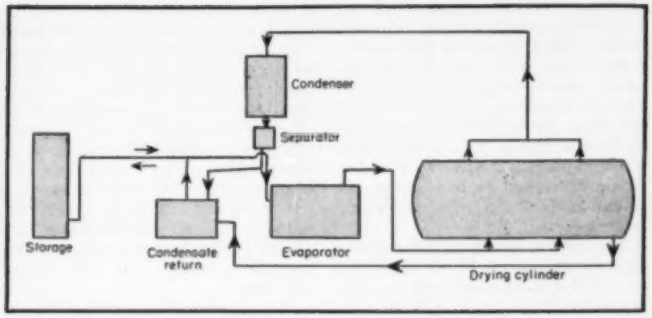
$$Q_T = 20.4\left[(\Delta F_T)^{0.543}\left(\frac{\rho}{\mu}\right)^{0.087}\right][\Sigma(\alpha)] \quad (16)$$

SERIES PIPING SYSTEMS

Given: The over-all pressure drop from *A* to *B* (Fig. 2) across the extremities of the series system, together with the lengths and diameters of the pipelines and the kinematic viscosity of the fluid flowing. Find: The volumetric rate of flow.

(Continued on p. 262)





Evaporator, right foreground, and processing cylinder, left—key equipment in the simple vapor drying circuit.

Wood Seasoning Jackpot: Vapor Drying

Time: Slashed from months to hours.

Product: No more checking or splitting.

Cost: Comparable to traditional methods.

JAMES A. LEE

Chemical engineers have once again made a liar out of the sage who said "You can't teach an old dog new tricks." This time it's wood preserving, an old, old dog that has learned to parlay some applied chemical engineering principles into a major forward step for the industry. First commercial process for solvent seasoning of lumber (railroad crossties, in this case) is in operation at the Taylor-Colquitt Co. wood preserving plant at Spartanburg, N. C. Monie S. Hudson, company chemical engineer, developed the process. Its spectacular advantage is speed. It cuts seasoning time from a matter of months to 14 to 16 hr. Besides, it turns out a superior product and does it economically. And it promises a tremendous new market for chemical solvents.

PROCESS

A cylindrical pressure vessel or autoclave, like those traditionally used in wood preserving plants, serves as the processing chamber. Lumber in a charge is separated into layers with 1-in. spacing strips to let the vapor get at all surfaces. To generate the drying vapor, an evaporator boils the solvent. Once in the cylinder, the chemical releases its heat of vaporization, condenses on the charge, and rapidly supplies heat to the green wood so that the contained water is vaporized. The excess of organic chemical vapor sweeps the steam over to the condenser. There the temperature is lowered enough to cause condensation of the mixture. Condensate passes into the continuous decanter where the water and drying agent separate. Water is discharged from the system through the calibrated drain tanks. Drying agent passes into the condensate return tank which is also receiving water-free drying agent that is condensed in the cylinder. A pump transfers the chemical back to the evaporator and it begins another circuit through the system. The cycle is made up of a drying period ranging from 12 to 14 hr. followed by a vacuum of 2 hr. to remove any solvent retained by the wood.

PRODUCT

Productwise, the vapor process gets around many disadvantages of the long-established kiln-drying and air-drying methods. As opposed to kiln drying: it does not cause case hardening which interferes with further preservative treatment; it avoids deteriorating influences of steam or high-temperature air like hydrolysis or burning. It also shows up air drying: it does not develop cullage or infection of the wood from fungus organisms such as blue sap stain or true wood destroyers; it eliminates checking and splitting of the wood.

Vapor drying can extract materials from the surface of pines and other resin woods thus greatly improving paintability. Better distribution and deeper penetration of preservative is obtained in vapor dried wood.

COST

Costs of the process are comparable to those of kiln drying and higher than air drying. However, losses during the long air drying period in many instances far outweigh cost of artificially drying. Annual savings directly resulting from the shortened processing period include: elimination of interest on investment; reduction of fire insurance because of reduced stock in the yard.

Comparatively little additional equipment is necessary to adapt a standard treating plant to the vapor drying process and the conversion job can be done at low cost. Change-overs have been made at wood preserving plants at Radford, Va., and Petone, Wellington, New Zealand. More plants are being planned for immediate construction in that country and in Australia. Taylor-Colquitt is exclusive licensee under developer Hudson's patents and will issue sub-licenses to any company desiring to use the process, at a nominal royalty charge.

SOLVENT

Each of the American plants is consuming a tank car of solvent per month. Shortly production will be doubled in both plants and likewise consumption of solvent. In the drying of massive timbers such as poles and

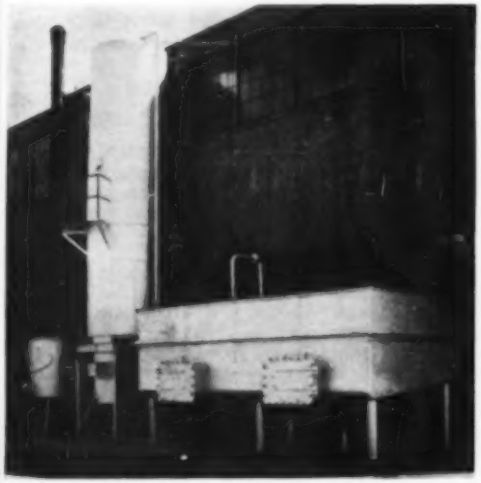
JAMES A. LEE *is* Chemical Engineering's *southwestern editor.*

ties about one half pound of solvent is retained in each cubic foot of wood. On the Class I railways in this country at the present time there are approximately one billion ties. The annual renewals constitute about 5 percent of this total. Since there are about 3.5 cu. ft. in a crosstie, 1.75 lb. of solvent will be consumed in each tie. If all ties should be treated by this process, an enormous market for the solvent would be developed.

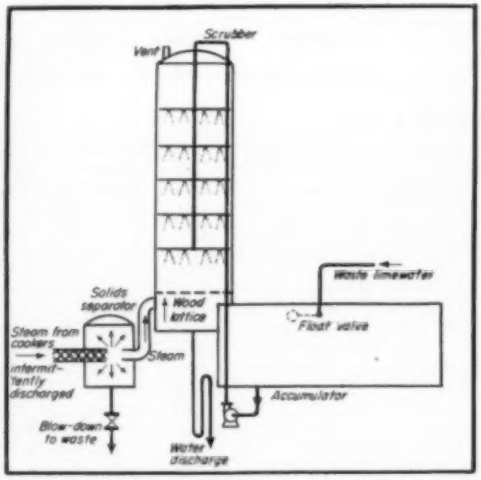
The general specification for drying agents is as follows: (1) It shall have an initial boiling point between 212 deg. F. and 400 deg. F. (2) Not less than 75 percent shall distill in the first 25 deg. F. after the first drop. (3) The material shall liberate no corrosive products when refluxed for prolonged periods in the presence of water vapors.

Another important factor that must be considered in the selection when vapor drying is to be used in conjunction with preservative agents such as creosote or creosote coal-tar solutions is chemical characteristics. In such cases the drying agent should have sufficient compatibility with the preservative to prevent formation of insoluble resinous products that would be deposited on the evaporator heating surfaces thus cutting down the rate of heat transfer.

A final point that is of importance in selection of the drying agent is that of the solidification temperature of the chemical. Since a liquid phase separation of water and drying agent is performed it is necessary that the mixture be cooled below the boiling point of water to effect complete condensation, because the mixture of the immiscible substances will have a boiling point below that of water. To prevent the escape of any chemical from the system, which is open to the atmosphere, it has been found necessary to cool the mixture to at least 180 deg. F. at the condenser. If the drying agent solidifies or begins to deposit solid constituents at temperatures above 180 deg. the condenser tubes will be coated and proper performance prevented. For this reason the drying agent should contain no crystalline material when heated to 180 deg. F.



Inexpensive, specially designed equipment bars pollutants.



Drawing shows simple operation scheme of equipment at left.

Odor Elimination Process Is Simple, Ingenious

J. V. HIGHTOWER

Steam cooking animal wastes can be pretty noisome. At least anyone within smelling-range of Consolidated Chemical Industries' San Francisco plant thought so. Producing a mitrogenous fertilizer is their business—not atmospheric pollution. So management decided to rid the plant and the atmosphere of odorous byproducts.

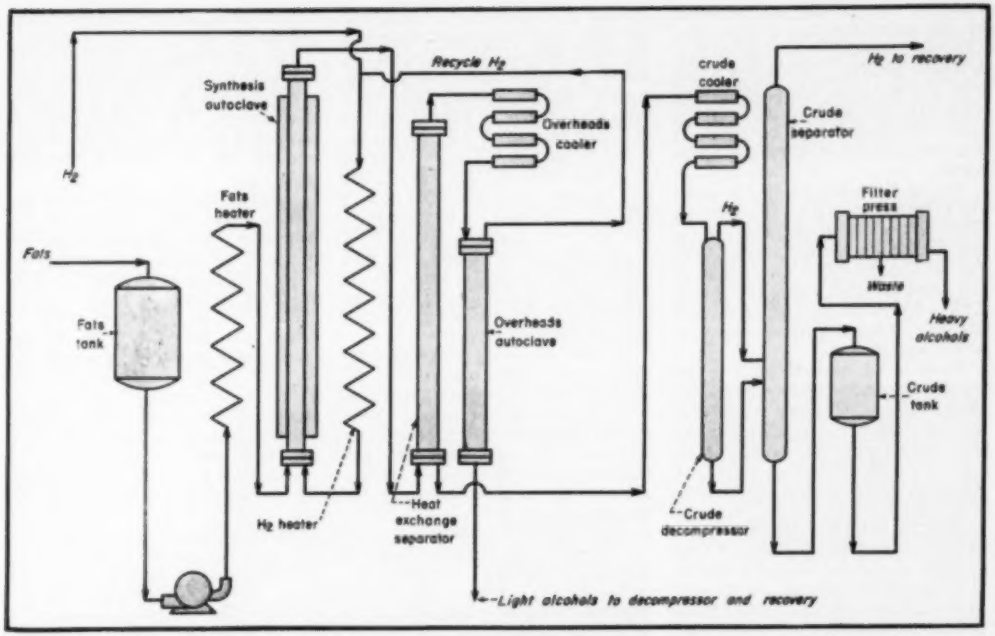
A company team enlisted the aid of W. J. O'Connell of San Francisco, designed a bang-up system using reclaimed plant equipment constructed at minimum cost.

In a nutshell, steam from the cookers, charged with odors is centrifuged by passing it through a steel helix 8 in. wide and 3 ft. long. Solid matter is thrown out into a solids separation drum (see cut).

Steam flows into the bottom of the 8 x 25 ft. scrubber, rises through a wood lattice. Waste product lime water (used to process hides in the plant) is sprayed into the scrubber at about 200 gpm. The water condenses steam, absorbs odor-producing gases. Condensate and lime water are continually drawn off through a gooseneck from the bottom of the scrubber. Solids are periodically blown down from the drum along with some condensate. That's all.

Only working part is the small centrifugal lime water pump; only operation is the actuation of the pump by the cooker attendant whenever steam is being discharged from a cooker.

J. H. HIGHTOWER, our *West Coast Editor, passes along a good idea from a San Francisco plant.*



Top yields are obtained by high hydrogen circulation rate and by keeping temperature and pressure constant during cycle.

Hydrogenation Yields Fatty Alcohols

First plant using De Nora high-pressure hydrogenation process in United States is now running. Here are details on the process.

RICHARD F. WARREN

First commercial plant in the United States using the De Nora process for high pressure hydrogenation of fats and fatty acids to fatty alcohols is now operating at the Procter & Gamble plant in Long Beach, Calif. Procter & Gamble's unit is a semi-continuous experimental plant turning out about 5 tons per day. (See *Chemical Engineering*, Nov. 1950, p. 74.)

BATCH VS. CONTINUOUS PROCESS

The DeNora hydrogenation process for the production of fatty alcohols can be carried out in a semi-continuous or continuous system. Due to technical considerations, the continuous process plant is employed only for capacities of more than 10 tons per day. For smaller capacities the semi-continuous process has been employed to date.

In designing and constructing a semi-continuous plant equipment is set up on a base operating cycle. The cycle gives a production capacity not much lower than the capacity of a continuous plant having a synthesis vessel of the same volume.

This means that, in practical operation, a batch process does not have some of the drawbacks of a continuous system and is preferred whenever quality of the raw material is expected to change frequently.

In batch operations the product may be controlled on the basis of maximum absorption of hydrogen that is compatible with the operating conditions and desired product. In a continuous process such absorption may be related only to a previously established time of reaction and to certain flow rates. Therefore, the best results are often obtained with the batch process, even though one excludes from consideration varying reactivity shown by different oils and changing activity of the catalyst.

In continuous plants two different methods for employing catalysts may be followed. Catalyst may be fixed, or it may be mixed with the fat, in which case it flows continuously out of the reaction vessel along with the alcohols produced. The fixed system is good for reactions between gases. However, in the production of fatty alcohol it is more desirable to carry out the reaction in a liquid stage.

RICHARD F. WARREN, Chemical Engineering's *market editor, prepared this story from information supplied by Dr. Vittorio de Nora. Dr. de Nora is Italy's world famous chemical engineer. In addition to this process the de Nora electrolytic cell is another of his important achievements.*

Catalytic material used for reduction of fats to alcohols has a short life. Moreover, activity of a fixed catalyst is rapidly reduced. This makes necessary a continuous rearrangement of operating conditions as well as frequent replacement of the catalyst. It also involves tearing down the equipment.

Mixing the catalyst with the material to be reacted is a tricky operation. There is a possibility that obstructions will occur and obnoxious residues from the exhausted catalyst may collect in the reaction vessels and in the piping. This is further complicated by the fact that the catalyst may deteriorate by reaction with the fats.

There is a further difficulty of unsteady control of injectors and discharge valves, since these will be controlling a suspension of solid particles in a fatty substance. Calibration of the inlet and outlet controls, particularly if flow rates are limited, is very difficult.

In semi-continuous (batch) plants the temperature and pressure are kept constant during the complete operating cycle. The hydrogen gas as well as the mixture of fats and catalysts are preheated to the reaction temperature before entering the synthesis autoclave. This makes it possible to start the reaction at the beginning of the charging operation and to allow the reaction to go on while the charge is being introduced. The reaction continues until hydrogen absorption is no longer noticeable. Then the hydrogenated liquid is transferred in the hot state to another vessel. This is the only operation which requires a loss of time in comparison with the continuous process. This loss ranges from 10 to 15 percent of the total time, depending on the plant size. Theoretically, this type of plant design would result in a production capacity of about 85 percent compared with a continuous processing unit. Practically, however, the batch system gives higher results than the continuous process in commercial operation of small plants which have to use different raw materials. But feed pumps, fats heater, and crude cooler are larger in batch system than similar continuous units.

PRODUCT SEPARATION

Reduction of an acid to the corresponding alcohol takes place according to the following general equation:

$$R-COOH+2H_2 \rightleftarrows R-CH_2OH+H_2O$$

This is an equilibrium reaction. It will go completely and at the highest possible speed only if the secondary volatile component is continuously removed from the reaction area.

When producing fatty acids from coconut oil it is necessary to deal with mixtures of acids containing from 6 to 18 carbon atoms. This means that alcohols produced have different degrees of volatility. Partial pressures will vary. The presence of volatile items in the reaction vessel will lower the actual pressure of the hydrogen by an important amount. This will increase the reaction time. To avoid this, a De Nora plant pours a fast stream of gas into the reaction vessel. This causes efficient contact of fats with catalyst and hydrogen, strips off reaction water as well as volatile members of the alcohol series, allowing them to condense separately.

Another advantage resulting from this procedure is the separating of the alcohols into light and heavy fractions.

In operation of the continuous process (see *flowsheet*) fatty acids or other fatty materials and hydrogen are preheated to about the operating temperature in two separate heaters under operating pressures. Then they are introduced into the synthesis autoclave.

The catalyst, dispersed in fatty material or in the alcohol, is fed separately. The synthesis autoclaves are provided with an electric furnace or a Dowtherm vessel which raises the entire system to the operating temperature and maintains the unit at the proper temperature during operation. In the continuous De Nora hydrogenation plant two autoclaves are connected in series. They are provided with apparatus for dispersing the hydrogen and fatty material and bringing them into intimate contact with each other and with the catalyst. The temperature is automatically controlled. Safety devices are used for the control of pressure and liquid level.

The crude alcohols (with the catalyst) are continually discharged from the last autoclave in the liquid phase. They are mixed with overheads from the processing autoclave in vapor phase and the hydrogen.

The entire mass of reaction products is cooled in a heat exchange separator in order to recover part of the heat content. The heavy fraction is discharged from the bottom of the separator and the overheads from the top.

Overheads are condensed in the hydrogen cooler and continuously recovered in the overhead receivers. The recovered material is continuously discharged through a decompressor into a settling system.

After further cooling the crude alcohols and the catalyst are decompressed and continuously recovered. By centrifuging and low-pressure filtration they are separated from the catalyst. The catalyst recovered by the centrifuge operation is recycled after some fresh catalyst is added.

Hydrogen is separated by cooling the condensable products entrained with it. Then it is preheated to the proper temperature and recycled into the synthesis autoclave. The hydrogen is always maintained under pressure. The hydrogen replacing that absorbed by the reaction is continuously fel to automatic valves which are used to keep the pressure in the synthesis system constant.

EQUIPMENT DETAILS

The synthesis autoclave for a 35-ton-per-day plant consists of a hollow cylinder flanged at the end with the following dimensions: Length 10 m., inner diameter 300 mm., and wall thickness 60 mm. The cylinder heads are 316 stainless steel or stainless-lined alloy steel for the first autoclave and alloy steel for the second autoclave. Flanges are chrome-molybdenum steel and the studs are chrome-nickel-molybdenum steel.

Recirculating hydrogen is preheated at a high pressure in a chrome-molybdenum steel autoclave equipped with a 304 stainless heating resistor or in a stainless steel pipe coil of special design. The heater is rated at about 800 kva. for this 35 metric ton-per-day plant.

Fats are preheated at high pressure in a 318 stainless steel coil that operates the heating element. The control power is about 550 kva for the 35-ton-per-day plant. Fats and catalyst slurry are fed separately into the high-pressure system by 318 stainless triplex piston pumps. These pumps are built for a variable output and the components subject to wear are in solid Stellite or Stellite lined. Maximum operating pressure for the pump is 350 atm.

Hydrogen recirculating pump and

Plant Requirements

(Per 1,000 lb. Higher Alcohols Produced)

Coconut oil	1,180 lb.
Catalyst (cupric-chromite type)	15 lb.
Hydrogen (0° C and 76 mm.)	6,000 cu. ft.
Steam (20 psi.)	500–1,200 lb.
Water	1,500–3,000 gal.
Labor (man-hr.)	10–40
Electricity	500–700 kwh.
Industrial yield/theoretical yield	95–98%

Investment

(All equipment for U. S. plant)

Continuous process, 35 metric ton per day cap.	$1,500,000
Batch process, 1 metric ton per day cap.	$200,000

Major Operating Features

Pressure	330–250 Atm.
Synthesis autoclave temp.	330–340 C.
Hydrogen inlet temp.	350–360 C.
Fat inlet temp.	300–310 C.
Dephlegmator temp.	110–130 C.
Hydrogen flow rate	Equivalent to replacing gas 20 times per batch.

compressors have no special design features. They are built to operate at 350 atm. The recirculating pumps are equipped with output regulation between half and full capacity. The head of the recirculating pump is 20 atm.

In batch operations De Nora plants use only one synthesis autoclave. This unit is equipped with an apparatus for distributing the hydrogen and fatty materials. This carries them into intimate contact with each other and the catalyst. Devices for automatic regulation of temperature and safety devices for the control of pressure are included.

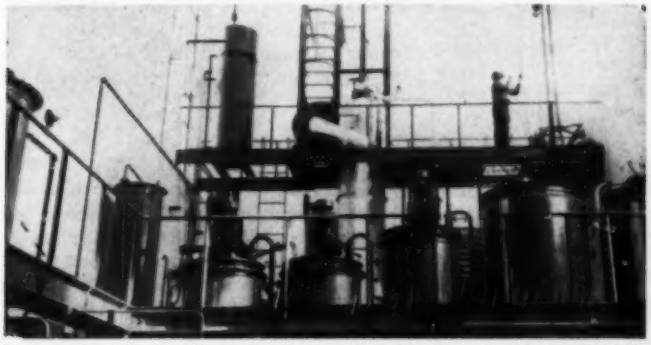
A dephlegmation system is connected to the top of the autoclave. Overheads are condensed in a hydrogen cooler and continuously recovered in the overheads receiver. The overheads are discharged from the high pressure receiver to the decompressor at the end of each batch.

Crude alcohols are discharged from the synthesis autoclave in the high pressure receiver through the cooler. While the next batch is on stream, crude alcohols are discharged from the high pressure receivers to the decompressor. By low-pressure filtration they are separated from the catalyst. The recovered catalyst is recycled.

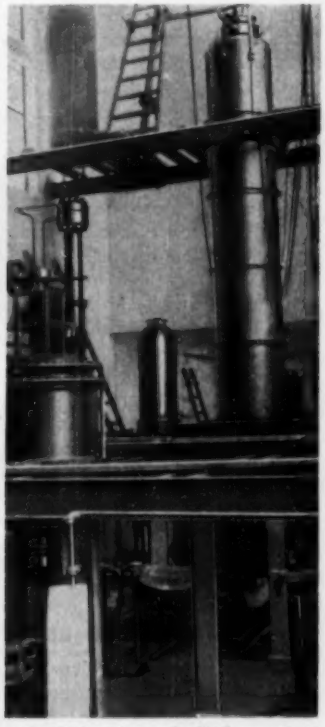
COST DATA

Approximate cost of all equipment for a continuous plant for the production of 35 metric tons per day would be about $1.5 million and for a batch plant of 1 metric ton per day capacity the price would be about $200,000.

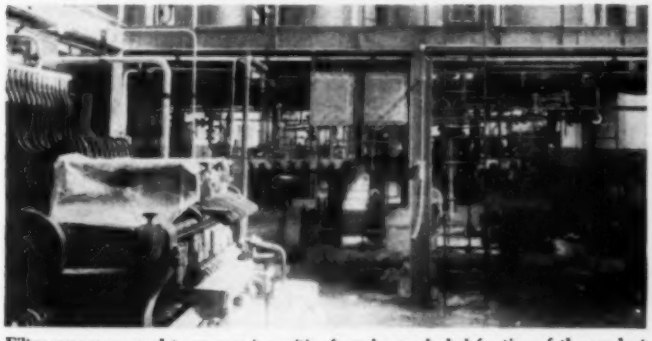
50 Tons of Fatty Alcohols per Month



Products of this National Starch Co. plant at Alexandria, Egypt, include fatty alcohols from vegetable fats. Synthesis autoclave is shown in center.



Filter feed tank, overheads decompressor and autoclaves show size of unit.



Filter presses are used to remove impurities from heavy alcohol fraction of the product streams. Filter feed comes from crude storage tank.

Controls and high pressure manifolds for hydrogen gas and for liquids are part of this 50 ton-per-month unit of National Starch Co. in Alexandria.

OPERATING DATA

Raw materials
Coconut oil
Cottonseed oil

Products
Sulphated fatty alcohols

Capacity
100,000 lb. fatty alcohols per month.

Markets
Detergent producers
Textile industry

Editorial Viewpoints

This Engineering War

This time the national defense effort is following a different pattern than the one we used ten years ago. The emphasis then was on mass production. Vast quantities of finished munitions were urgently needed for a shooting war. Today's strategy is to ready new and existing productive capacity, to acquire the needed know-how and eliminate "bugs" and bottlenecks that might later delay rapidly expanding operations. All this puts a much greater strain on management, engineers and the suppliers of capital equipment.

Another obvious difference is the extent to which this is a capital goods war. In 1941–2, private investment in military facilities averaged about $8 billion per year. Now the annual rate is over $60 billion. In the 1943–4 period, private capital goods were only about 10 percent of the munitions output. In 1951–2 the ratio will be many times as great.

More technical skills are needed in research, design and development than at any time during World War II. This is due both to the complexity of military requirements and the need for new materials and equipment for modern weapons.

Chemicals continue to be critical and strategic materials for the whole program. Current shortages would be greatly aggravated by any sudden return to the production schedules of World War II. This means that the expansion program for new chemical plants and equipment must be rushed to completion, despite the longer-range threat of excess capacity for a purely peacetime economy. Any other procedure might leave us dangerously short of essential munitions in case of an all-out war effort—with 12 million or more men in the armed forces

Ride Hard Your Hobby

One of the grand old men of our profession was given belated honor when the 1951 Perkin Medal was awarded in absentia to Henry Howard. Stricken in Boston by a serious illness he was unable to attend the meeting in New York. But his memorable address, as read by his son, and the record of his achievements, as recited by one of his younger employees, Francis J. Curtis, give us an invaluable insight into his strong character and remarkable career. You will enjoy and profit from reading both addresses soon in the pages of *Chemistry and Industry*, the official organ of the British Society of Chemical Industry.

But there is a part of his personal philosophy that bears repeating here "Every man, no matter how immersed in his profession, should have a hobby, and sometimes he will not be able to tell where the one commences and the other leaves off. . . . Each one opens different doors, but a profession that you love all your life can certainly be your greatest hobby. If you truly love your profession, there are no boundaries to it, and you sometimes cannot tell in your own mind where work leaves off and play begins."

In Henry Howard's long and productive career, he has ridden many hobbies. Yachtsmen know him for his racing records. Plant men know him for processes and equipment that still bear his name. The industry knows him best for his long years as president of the Manufacturing Chemists' Association. But all of us respect and revere him for making our profession his life-time hobby.

Youthful Services to Humanity

Every draft board in the country could profitably study the records of pharmaceutical research presented by Merck's Randolph T. Major in accepting the 1951 Medal of the Industrial Research Institute. Most of his talk was devoted to the scientific achievements of young men who have contributed notably to human welfare. Lewis Sarett, for example, was only 24 years old when he was deferred from military service to work on certain steroid hormones needed by the Air Force. From this work came the first synthesis of cortisone, which has already meant so much in the relief of suffering from rheumatoid arthritis. Joseph Cline was under 30 when he began his collaboration with R. R. Williams in the first synthesis of a vitamin, vitamin B-1 (thiamine). Albert Schatz who, with Selman Waksman, discovered streptomycin during the war years was under 25. Boyd Woodruff who did the important work in developing practical production processes for streptomycin was not yet 30. Of similar youth were many of the chemists and engineers who perfected the fermentation processes for penicillin—thereby saving the lives and reducing the suffering of untold thousands of sick and wounded soldiers and civilians during World War II.

The average age of the Merck research staff today is 32. This is the group that contributed so much to the development of vitamin B-1, penicillin, streptomycin, vitamin B-12 and cortisone. "I feel confident," said Dr. Major, "that every one of these drugs would not have found its place in therapy nearly as soon, or perhaps not at all, if competently trained, imaginative young men had not been available for work on them."

Let's not forget—nor hesitate to point out to our fellow citizens in the Selective Service, that unless provision is made for continuing the training of young scientists in our universities during the coming

years of war and tension, men like Sarett, Cline, Schatz and Woodruff will not be available for essential research projects on which our very lives may depend.

Randolph Major, able and inspiring leader and research administrator, deserves the thanks of the chemical profession for focussing national attention on the outstanding services of youth to humanity.

Where Guidance Is Needed

Ever since the U.S. Bureau of Labor Statistics broadcast its spurious warning of a threatened glut in the market for engineering services, there has been a serious drop in college enrollments. Some branches of engineering have suffered more than others—chemical engineering, for example, is no longer second to mechanical but now follows civil engineering in fourth place while electrical engineering has climbed to the top of the list.

Relative rank is less important, however, than is need for greatly increased guidance to aid high school students in determining whether they are qualified for careers in engineering. Local engineering societies and sections and chapters of national engineering societies are urged to establish active guidance committees. To help in this process the Engineers Council for Professional Development has just prepared a 15-page Guidance Manual. It is supplemented by a separate appendix, "Shall I Study Engineering," which is a questionnaire to be filled out by the student himself as the basis for discussing his qualifications with an engineering advisor. A sample copy of the manual and questionnaire can be obtained from ECPD, 29 W. 39th St., New York 18, N. Y., for 20 cents.

CPR-22 Spells Trouble

This month the Chemical Economics department deals with a current headache—CPR-22—the general manufacturers regulation for adjusting price ceilings. Unfortunately for chemical industry the directive provides no relief for increases in overhead resulting from increased research expenditures and the mounting costs of new construction. Wages and raw materials are the only bases for price adjustments.

For some commodities this raw material-wage formula may be applied without too much difficulty. But in the case of most chemicals, it becomes infinitely complicated. An organic compound, such as 2,4D, for example, may be made from a half dozen intermediates, each of which may have several other end uses and therefore share in labor and raw materials for a number of related operations. The physical task of calculating costs and adjusting prices for literally thousands of chemical products and byproducts is too terrifying to contemplate. Little wonder, therefore, once the unrealistic and impractical character of CPR-22 was discovered, the chemical industry was among the first to obtain a postponement of the original May 28 deadline for filing the preliminary reports.

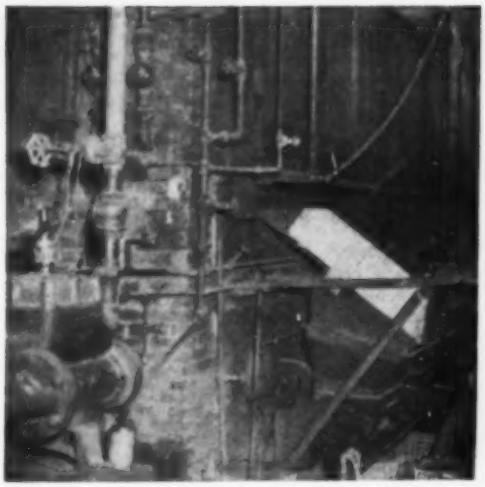
But quite apart from the excessive bookkeeping involved in the detailed workings of the price directive, there is ground for more serious criticism in the penalty it puts on research and expansion programs. We cannot be prepared for an all-out war effort without building new facilities and modernizing old ones. This we are encouraged to do by the defense agencies that hold out the promise of faster amortization to write off the cost of such operation. Now comes the Office of Price Stabilization to hold that increased overhead cannot be considered in any price adjustments. It is this inconsistency in government policy that must soon be corrected if industry is to do its part in the mobilization program.

Why the Apathy?

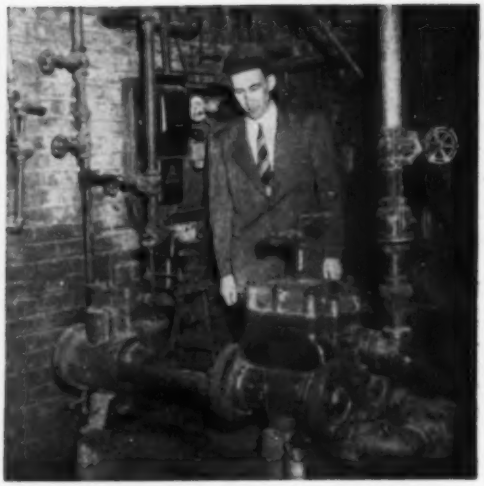
In a recent article on plant location in the *Harvard Business Review*, Frank E. Gilmore reports that there has been very little conscious effort to relocate industry for security reasons. This apathy toward dispersal for security is but a reflection of the more general attitude of the public toward civilian defense and the protection of industrial property. Who is to blame and, more important, what's to be done about it?

Are we alone in believing that the publications and speeches of the Federal Civil Defense Administration have failed completely to impress either industry or the general public? Some of these outpourings are far beyond the range of our credulity. In a recent talk to the American Society of Newspaper Editors, FCD Administrator Caldwell tried to lay the apathy problem in the laps of the press. In the same speech he presented as sober facts a four-point statement to the effect (1) that the Russians now have enough atomic bombs and planes to assault all our major cities in one bold attack; (2) that there is little or nothing we can do to stop them; (3) that attack will come without warning; and (4) that the Russians are capable and ready to deliver this destruction whenever they feel it is most profitable for them to do so.

As far as we can observe, this "shock treatment" technique is highly ineffective. It seriously damages the persuasiveness of many sincere speakers who present more credible and logical reasons for protecting civilian and industrial centers. But despite these distortions, chemical engineers and executives have heavy responsibility for plant protection in the process industries. Every phase of the problem must be studied realistically. It begins in the screening of personnel to eliminate the risks of sabotage and other possible sources of accidents and physical damage. It involves critical study of all potentially dangerous facilities. And it may even extend to top management for important decisions on the proper dispersal of new or existing plants to help preserve our way of life.



PROPER CARE keeps boilers going. This one is 35 years old and is operated at 50 percent overload with nightly shutdown.



OVERSIZE PUMPS for feedwater are an economical investment for medium-size boilers says normal-size Author Miller.

Power for the Small Chemical Plant

Must you run the power plant too? Steam generation is part of the chemical engineer's responsibilities in many of our smaller plants. If it's part of your job in your plant, here are 85 practical and helpful operating tips.

ROBERT L. MILLER

Most of the engineers graduating each year are taken by large companies and put through training programs. They will continue on in these companies and similar companies doing research, engineering, production or other specialized tasks.

A small percentage of venturesome men, however, take on the job either of chief engineer, chemist, or plant superintendent of some smaller enterprise—a job where they are considered an authority on every scientific subject that comes up.

If it is a chemical manufacturing concern, it has a boiler or steam generating station of some type. This problem has been aptly taken care of in the larger plants by mechanical engineers, and, except for water treatment, probably has been of little concern to the chemical engineer.

R. L. MILLER *is a consulting chemical engineer now with the Northern Ohio Engineering Co., Barberton. He has had seven years' experience with boilers—two poorly designed ones and a good one. He has designed and is now installing a 1,000-hp. job.*

This article will point out possible pitfalls in the operation of the small boiler and show where to seek advice. These remarks, in general, apply to boilers from 5 to 500 hp. and pressures ranging up to 150 psi.

The philosophy involved in the operation of boilers is unusual. Whether large or small, the boiler plant is an orphan. If it runs well and an occasional check shows sufficient capacity and fairly good operating efficiencies, the attitude of executives and production men alike is: "Let it alone!"

This philosophy is brought about because the men who operate the boiler are licensed, the boiler is inspected regularly, the process is one of the oldest on record and pretty well standardized, it is often a dirty, hot hole and a necessary evil.

If you have a boiler to take care of here are some things that will help.

10 General Tips

First of all, look at your boiler. Look at others too. In spite of the fact that the boiler cleanouts are made on weekends, come in and take a look, and on the way home stop at the brickyard and take a look at theirs and talk to the fireman on the job. (The chief engineer may have the philosophy mentioned above.) There is nothing that will pay bigger dividends than this advice.

Keep what records are necessary. The amount of coal used, the chart off the pressure recorders if you have one, occasional CO_2 tests on the stack, the stack temperature, boiler feedwater temperature and treatment (feedwater) used and what others seem pertinent. In addition, keep a record of all repairs and new installations made in the boiler house. When breakdown jobs are carried on, keep a record of who did what and where he got the tools.

Know exactly what the fireman does. Can he haul coal? How much boiler repair can he take care of? Under most conditions the night man can make watchman's rounds. This may interfere with union ideas, but can generally be done. It is almost axiomatic that if enough automatic controls are installed in the boiler to make it operate efficiently, the fire-

Why do boiler plants have to be orphans? When do you add hardness to make scale?
Can your fireman fire and haul coal too? Does overheating or scale cause the leaks?
How hot should your boiler feedwater be? Do expansion & contraction ruin a boiler?

QUIZ emphasizes some of Author Miller's points. Answers at the bottom of the page, but his text gives fuller explanations.

man will have a fairly easy time of his job.

Make certain that all elements of a unit are in good repair before trying to improve on efficiency. This holds true for boilers as well. However, don't hesitate to check the efficiency at any time. It is a direct chemical engineering heat balance to analyze CO_2, take stack temperature and measure steam (or feed water). However, samples from the ash pile will tell many combustion stories that are often missed.

5 Tips on Coal

Don't take unloading of coal for granted. Maintenance and direct labor can run into sizable figures. However, it is a poor policy to install an expensive coal handling system for the comfort of a fireman who has little else to do anyway. The same goes for an ash removal system.

In coal fired boilers check the grates. In a good system grates will last for 20 years without repairs. However, I have seen many in need of replacement within a year after being installed. The clue to keeping grates is to keep them cool. This means distribution of air evenly over the surface. Here again too many factors, such as coal, firing technique, etc., enter in to permit generalizations.

Look at the control system from time to time. Personal experience again has shown the oil-hydraulic system powered by a ¼ hp. pump to be vastly superior to any other in controlling coal feed and underfire air. Similarly, a thermostatically controlled water level gage is less troublesome than an electrical gage. Most firemen will be found weak in understanding these controls. It will be necessary to delegate responsibility to one man.

12 Tips on Water

There is considerable argument over how hot feedwater should be. The hotter the better as long as you do not have to use steam from the boiler, i.e., as long as you can recover waste heat. In all events, at least 150 deg. F., even if you have to use steam directly from the boiler. Always vent the feedwater tank after the water is heated and keep at least 10 ft. suction head on the hot water on the feed water pumps. From my experience, special feedwater heaters are not practical on small boilers largely because amount of water is not sufficient to justify them.

Keep a close watch on water treatment. In my opinion, there is no equal to zeolite softened water followed by a little sodium sulphite treatment or its equivalent. The installation cost can be kept down by discharging the softener into a tank holding a 4-6 hr. supply of soft water. This will take care of the surges and also permit daily recharging of the softener. There is no apparent harm in working a softener this hard if it is properly designed.

Examine the condensate coming back to the boiler. In chemical plants this can be a source of trouble. If contaminated it should be run through a heat exchanger countercurrent to treated incoming feedwater. Continuous or intermittent blowdown can be piped through this same heat exchanger for heat recovery.

Be sure that the feedwater pumps operated well. Most units are still of the duplex steam variety. In general, don't change the timing of these pumps even though their outward symptoms tempt you to do so. The only difficulties result from cylinder packing and valves in the water end. Other factors may come up (such as improper oil separation from the steam cylinder) but in several years I have never had to do any more on the steam end than to repack the shaft packing box.

5 Tips on Smoke

Comply with local ordinances on smoke and fly ash. There are smoke control people available to help the engineer out on this. They have several good papers which are apparently not available from other sources. Fly ash is more troublesome than smoke and will require a small diameter collector in conjunction with a fan. Fly ash is often partly combustible and may amount to as much as 2 percent of the total fuel.

Soot blowers come in for considerable speculation. The best one is a conscientious hand blowing job by a fireman or night man at low fire. If this can't be arranged, many arrangements that travel steam jets across the areas likely to be sooted are satisfactory, but the job still should be done by hand with a steam jet and a brush once a week if possible. Chemical soot eradicating compounds have their place, but I have never found them economical.

18 Tips on Steam Use

Keep after lower steam consumption. Wasted steam is wasted money. Secondly, get a shorter boiler day. Shorten operations whenever possible to make the period of full steam pressure shorter. This again is simply good business. Oftentimes a 5 to 50-hp. automatic boiler will pay for itself in a few months by relieving duty on the large boilers during the slow periods in the week.

Make a periodic check of traps. It is often the practice of young engineers to put bypasses around traps. This is a dangerous and expensive way of neglecting the job of keeping traps in working order. If traps clog or stick, installation of traps in parallel with double valves and unions will permit one's being cleaned or repaired while the other is being used.

Traps designed for the proper pressure should be used, largely because of the temperature differential. This is often the case where 5 lb. thermostatic traps are used on unit heaters operating under 100 psi. or more of steam. The solder rapidly works loose and the trap fails to operate.

Take an occasional look at steam quality (how much water it contains). Very often, old horizontal return tube boilers were not designed to give dry steam. Wet steam can ruin the operation of many steam operated units. A good way of helping this (besides correcting it by adjusting the load and the water treatment) is to trap out the ends of all steam headers.

The steam distribution system is as important as the boiler itself. First of all, the amount of steam being used should be metered at the boiler by a

QUIZ ANSWERS
Boiler plants shouldn't be orphans.
The fireman should haul coal, too.
Feedwater should be at least 150 deg. F.
Hardness is sometimes used on pitted tubes.
Overheating and scale usually cause the leaks.
Expansion & contraction needn't ruin a boiler.

flowmeter, recording, if not integrating as well. This is one of the few attachments to a boiler that really pays for itself in short order. Work from this meter. Attain a steady load and shut one unit down at a time to see how much steam that unit is using. A little extrapolation will soon give a good picture on steam usage in a small plant.

More or less of addenda, please bear in mind these generalities about the distribution system: Put the office heat on a separate line. Office help, including yourself, will not tolerate the heat changes that the rest of the plant can absorb. Provide for expansion of pipelines. Never tie steam together with water or air in any way. Beware of situations that will allow chemicals or oil to suck back into the steam lines when the steam condenses. Provide for freeze protection everywhere. Keep constant vigil on all valves and traps and provide enough valves so that parts of the system can be isolated to locate trouble.

6 Tips on Boiler Operation

Know how your boiler is being fired. This is not always indicated by the amount of steam produced. A better indication is examination of brick work. Most firebrick fuses at 2,800 deg. F. (depending upon type of brick). Fused sections of brickwork will show when overfiring is occuring.

Beware of periods of uneven operation. Efficiencies are generally checked for full load periods, while overloads and underloads generally cause the most trouble. There is considerable belief among boiler men that contraction and expansion will ruin a boiler and particularly the setting if the pressure is taken on and off and the fire is allowed to go down. I've had personal experience with boilers over 30 years old that operate consistently with 50 percent overloads that are shut down every night and allowed to cool off nearly every weekend. Don't generate steam that won't be used.

Use sufficient blowdown to keep the concentration of solids where it belongs. Continuous blowdown from the water-steam interface is simple and advantageous for any boiler of over 50 hp. These factors can be picked up from any good treatise on boilers.

6 Tips on Boiler Care

Keep boiler insulation in good repair. This again is only common sense. Keep all cracks patched to eliminate air currents inside the insulation. A properly insulated steam system will permit holding the hand on the surface of insulation at any place. It is a matter of conjecture whether valves and fittings should be insulated. Here again we have followed both practices.

Removing scale from a boiler when it has built up beyond the limit of good practice is a major problem. The easiest way is to bring it down slowly by gradually increasing the amount of alkali in the water treatment, washouts should be doubled in frequency. Pay particular attention to tube sheets and headers to see that no loose scale is accumulating.

The next best system is to get a simmering compound (10 lb. trisodium phosphate plus 10 lb. soda ash per thousand gallons of water) and put into the boiler over night while steaming slowly. Cool down the next day and wash out. This system may not work on certain types of scale. High pressure streams of water, properly applied, will dig loose scale. The other obvious solution is the acid circulating cleansing. The writer has never had occasion to use this.

23 Tips on Boiler Repair

While many of the above items should be worked out during the course of several months or years, the immediate problem that may hit the first week is the repair of the boiler. The boiler should normally be shut down every two or three months to be "washed out." This consists of cooling the boiler over a 12-hr. period and draining it. Then take off all the gasketed inspection plates.

At this point, examine the boiler for scale. First of all look at the bottom of the drum. If the scale is in the form of "mud" you generally have an effective treatment. If large sections of scale lie there, look further. First at the tubes. There 1/32 in. scale on a 100 psi. boiler is reasonable even with patches 1/16 in. thick along the tube. If more than that, correct with treatment. Also, if the tubes are perfectly clean, examine them for pitting. Sometimes, a little hard water may be added to form just a trace of scale if there is any indication of pitting of boiler tubes. Don't worry too much if there is scale up to 1/32 in. on one part of the boiler and practically none at the other. This is not an abnormal condition.

The danger point is the tube sheet in a fire tube boiler, or the drum or header in a water tube boiler. If scale builds up there, even loosely, (chunks of scale loosened from some other place on the boiler) the water will not carry heat away from the tube sheet and it will warp. This accounts for many boiler failures.

To wash out a boiler, get at least 50 lb. pressure on a ¾ in. hose and reduce the end to ¼ in. pipe. Elbows on the end may be necesary to get into some of the water tube or water wall sections. The impinging action of the water will loosen scale and wash it out the bottom. Do a good job here. Never take an extension cord into a boiler. Use a flashlight or a special low voltage light.

Replacing tubes is often a less troublesome job than stopping a leak in a joint. Be absolutely certain that the proper size tube, rollers and expanders are on hand and that a chain block is available to pull the old tube out. In returning the new tube, the seating surfaces must be absolutely free from dirt or scale. Do not seal weld a tube in place without an inspector's approval. Welding can cover up faulty work on the part of the boilermaker.

Repairing firebrick can generally be done by a good licensed fireman. Lately, our organization has had singular success with plastic firebrick which comes in sections 12 in. square by 2 in. thick. This is put in place with a hammer or mallet and with very little practice good walls and arches can be put up by any experienced mechanic. The watchwords with brickwork: prevent cracks where air can enter the setting; protect all metal components so that they will not burn out.

Leaks are generally caused by overheating and scale. Here it is best to seek the advice of an experienced boiler man. State codes are fussy about what must be done in repairing leaks in a boiler.

Above all else, keep safety in mind. A large percentage of industrial accidents still ocur because of steam. Uninsulated lines and valves should be marked. Return lines should be taken care of so that burns can be prevented. Lines under pressure should not be taken apart. Safety valves should be provided wherever necessary. In case of serious trouble, we find it a good policy to turn off the steam at the boiler. The exception to this is the case where water level is lost. In this case the fires should be pulled as quickly as possible. Turning off the steam at the boiler prevents trouble from multiplying and can be done without delay. This valve is normally wide open and consequently will hold pressure while many other throttling valves will fail to hold tightly.

In summary, always look, always avail yourself of the best advice, keep records and work safely.

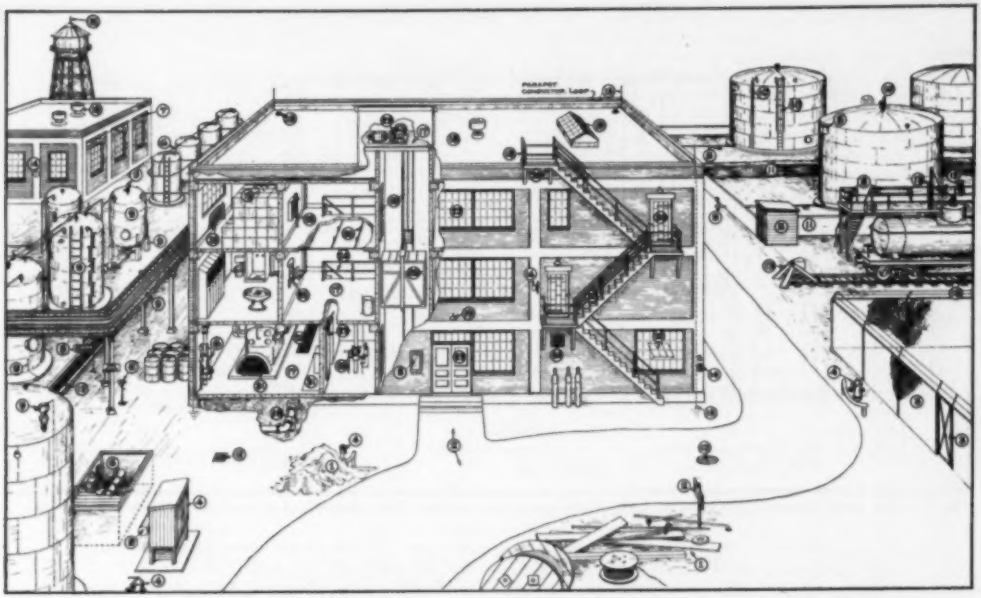


Fig. 1—Congested plants require special effort in securing adequate segregation of equipment (see note* for identifications).

DESIGNED FIRE PREVENTION

Through planning in the drafting board stage, in maintenance, and in personnel education, fire safety can be enhanced. This is designed fire prevention.

JAMES J. DUGGAN

CHEMICAL ENGINEERING REPORT—JUNE 1951

The objectives of fire protection engineering are several: to minimize opportunities for personal injury, loss of life, property damage, and production interruptions. These objectives are achieved by (1) prevention, (2) control, and (3) extinguishment of fire. It is the purpose of this article to discuss the first two objectives, prevention and control of fire, and their relationship to chemical process design.

Progress being made

In recent years considerable progress has been made in safe-guarding chemical processing plants against fire and explosions, both economically and adequately. With the experiences of the petroleum industry as a foundation, the newer chemical industry applied accepted fundamentals of fire prevention and control with excellent success. As this industry advanced and gained experience, it augmented these fundamentals and further minimized fire losses. Today, the

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Key to Fig. 1

* (1) Yard housekeeping; (2) Roads; (3) Fences, gates; (4) Yard fire equipment; (5) Foam systems; (6) Water spray systems; (7) Water curtains; (8) Personnel safety equipment; (9) Safety valves, insulation, fireproofing, gage glass guards; vent units, flame snuffers, flame arresters, grounding; (10) Field storage tanks; (11) Dikes; (12) Sewers, drains and trenches; (13) Tank car loading spots, railroad sidings; (14) Fire alarm systems; (15) Lightning protection; (17) Floors; (18) Roofs; (19) Lights; (22) Windows; (23) Doors; (24) Stairs; (25) Inside equipment; (26) Sprinkler systems and other fixed extinguishing systems; (28) Floor drains, trenches and traps; (29) Elevators, (30) Fire escapes; (31) Equipment and machinery safeguards; (32) Miscellaneous equipment.

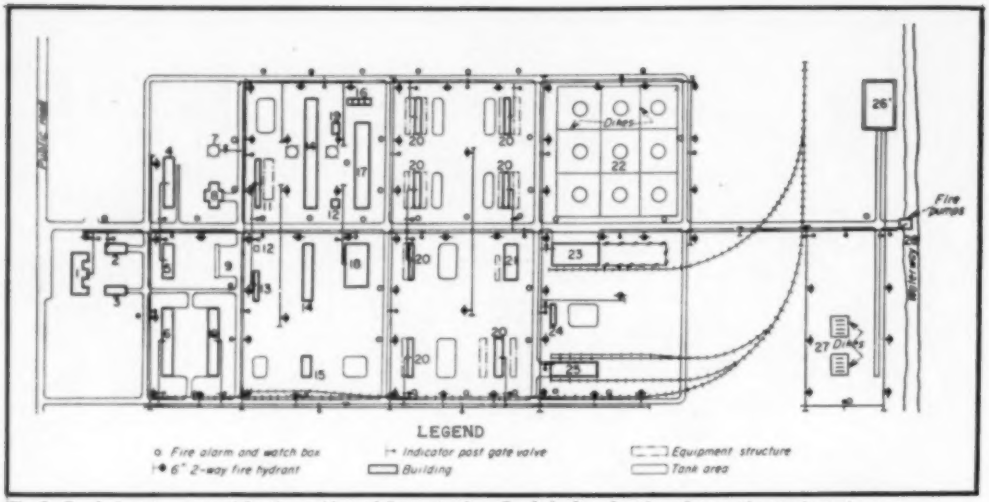


Fig. 2—Good plant layout simplifies the problem of fire protection. Symbols show location of protection equipment.

(1) Office; (2) Cafeteria; (3) Dispensary; (4) Laboratory; (5) Lockers; (6) Shop; (7) Elevated fire water tank; (8) Fire station; (9) Garage; (10) Stores; (11) Gas processing; (12) Unit office; (13) Gas processing control building; (14) Compressors; (15) Water treating; (16) Cooling tower; (17) Furnaces; (18) Steam and power plant; (19) Pump building; (20) Chemical processing units; (21) Air compressors; (22) Atmospheric field storage; (23) Warehouse; (24) Chemical mixing; (25) Shipping; (26) Sewage disposal; (27) High pressure field storage; (28) Pump house.

chemical industry has a good understanding of the application of fire prevention and control measures to chemical processes. Consequently, fire and explosion losses are being reduced.

Design for extinguishment

Fire extinguishing methods and equipment have been developed to a high state of efficiency for chemical plant use. This requires that the design of a plant recognize and provide for the extinguishment of those fires which cannot be prevented. The nature of some chemical processes makes extinguishment difficult, and in many the possibility of explosions is present. Naturally, the aim is to prevent fires and explosions as completely as possible.

Control of started fires

The term "fire control" refers to that phase of process design which seeks to control and protect against fires which have started, until available extinguishing forces can become effective. Certain ignition sources are unavoidable in many chemical processes. These may lead to fires and explosions through accident, lack of knowledge, or disregard for the elements involved. The term "fire prevention" applies to that phase of plant and process design which minimizes these hazards inherent in the process.

The application of fire prevention and fire control to the design of chemical processing plants is highly specialized in nature. It is influenced by ever-changing process requirements and the economics of the project involved. Insufficient experience sometimes makes proper evaluation of these considerations exceedingly difficult. However, certain practices are indicated as effective in the light of already available experience, and it is with these that the following discussion deals.

It is of prime importance in process design to recognize and incorporate the minimum safe practices prescribed by nationally recognized fire protection and engineering authorities and governing bodies. Table I lists a number of these. Such recommendations and regulations should be followed as closely as possible, and in every case supplemented as indicated by experience.

Minimize ignition sources

It is obvious that ignition sources or sources of heat are continually present in chemical processing plants. Their hazards can be minimized, however. Materials handled in the chemical industry include flammable solids, flammable liquids, high pressure gases, unstable compounds, and ordinary combustibles. Destructive or uncontrolled fires result from the exposure of large volumes of such materials to controlled or uncontrolled fires, or to other sources of heat in the presence of oxygen. (Controlled fires are safe fires which serve the purpose for which they are intended.) Since many processes need oxygen, they require precise process control for the prevention of fires and explosions. Situations conducive to combustion may arise from misoperation or mechanical failure of equipment,

Table I—Regulatory Groups and Information Sources

1. National Board of Fire Underwriters.
2. National Fire Protection Association.
3. Associated Factory Mutual Insurance Companies.
4. Underwriters' Laboratories.
5. U. S. Bureau of Mines.
6. Interstate Commerce Commission.
7. National Safety Council.
8. National Bureau of Standards.
9. American Petroleum Institute.
10. Bureau of Explosives (Assn. of Amer. R. R.'s).
11. U. S. Defense (Formerly War) Department.
12. Manufacturing Chemists Association.
13. Local inspection bureaus.
14. Local and state regulations.
15. American Society for Testing Materials.
16. Various material manufacturers' associations.
17. American Society of Mechanical Engineers.

Table II—Suggested Minimum Spacing for Hazardous Chemical Processing Plants

From	To	Distance in Feet*
Loading racks, locomotives, property lines and public roads	Any occupancy	100
Plants roads	Any occupancy	50
Manufacturing units (high pressure and unstable)	Any occupancy	125
Manufacturing units (ordinary flammables)	Any occupancy	75
Manufacturing buildings	Associated processing equipment	25
Manufacturing units	Unit storage	75
Fired boilers and furnaces	Any occupancy	150
Burning stacks and pits	Any occupancy	300
Gas holders and field storage	Any occupancy	150
Storage tank	Storage tank	Not less than diam. of largest tank.

* Where these distances are not complied with, additional fire-safe construction and fire protection should be provided. The properties of the materials handled and the volumes of materials involved are also important factors.

piping, and instruments. With inherent sources of ignition constantly present, fires and even explosions can and will occur. These should be anticipated and preventive features included in the design.

FIRE PREVENTION DESIGN

Plant segregation

Since fires will occur, one of the basic fundamentals of all designs is "segregation" to minimize fire damage and to permit effective control and extinguishment. The layout of Fig. 2 is a typical one, illustrating the segregation of occupancies according to the degree of hazard involved. For example, ordinary combustible occupancies might include offices, cafeterias, lockers, shops, stores, dispensaries, yard storage, and other service and administrative buildings. These should be grouped within a certain area of the plant, with suitable spacing between the individual occupancies. Provision should be made for proper fire extinguishing mediums in accordance with standard regulations. Garages can be included in this group if treated in this way.

Power plants

Steam power plants are continuous ignition sources and it would be preferable if they could be located in boundary areas. However, economics dictates centralized locations, and spacing between these adjacent occupancies should be well considered. This applies, too, to fired process furnaces and boilers which, for reasons of economy and efficiency, must be situated within or adjacent to processing areas.

Chemical units

Chemical units can be grouped according to the type of flammable material handled. For example: high pressure gas and liquefied gas processing units are grouped together. Bulk storage of the finished product is isolated from the other occupancies and also from the producing units. Ordinary flammable-liquid processing units are likewise grouped, as are resin and plastic processing units. In many cases, however, unstable compounds must be used with ordinary flammable liquids and stable materials under pressure, or one or more of these may be present in a resin processing group. The need for other designed methods of prevention then becomes evident.

Bulk storage facilities are best segregated by locating them in separated areas. However, when a certain process requires the storage of large volumes of flammable materials within or adjacent to the process area, fire protection facilities in excess of those normally provided are required.

A good plant layout usually will permit economical location of packaging and shipping facilities with a minimum of product transfer. In many cases the concentration of end products at these points creates high-value occupancies. Hence, maximum protection must be achieved, with adequate safeguards and proper segregation of the products.

Roadways for segregation

For the segregation of areas, plant roadways often assure adequate distances when other recommended spacings are observed. Segregation within areas can be achieved by adequately spacing the individual units and groups of equipment. This may be augmented by construction features which will tend to confine flammable liquids and fires that may result. Standard minimum requirements for fire safety are met when those areas where flammables are processed, handled, or stored; electrical and process control rooms; and other auxiliary areas are segregated. These, too, can be made more effective with added features that help to minimize any hazard.

WHAT DESIGNED FIRE PREVENTION MEANS—A NINE-POINT PROGRAM

Planning and Design

1. Use of intelligent plant and intra-unit segregation through adequate spacing, use of fire and explosion walls, dikes and trapped drainage, and provision of fixed fire protection.

2. Where adequate spacing and segregation are not possible, as in older installations, use of much greater outlays in fixed fire protection systems and protective construction. (See 3).

3. Use of fire and explosion resisting construction, exclusion of combustible materials, application of water sprays and sprinklers, use of insulation and fire-retardant paints, and provision of ventilation and explosion venting.

4. Isolation of severe hazards and ignition sources by distance and by heavy construction.

5. Use of electrical bonding and grounding to dissipate static and lightning.

6. Use of approved electrical equipment, tight enclosures, protective devices and systems, and their proper maintenance, to insure fire-safe electrical installations.

7. Development of inherent process and mechanical safety through conservative selection of materials and equipment designs, use of adequate instrumentation and pressure relief, the inerting of combustible vapors and the exclusion and control of unstable materials.

Maintenance

8. Development of complete preventive maintenance programs involving periodic inspection and reports, hot-work control, cleaning and purging procedures, good housekeeping, and waste removal.

Education

9. Thorough instruction and education in process and fire safety, including operation, fire and personnel safety schools, fire problems, and a realistic system for process emergency control.

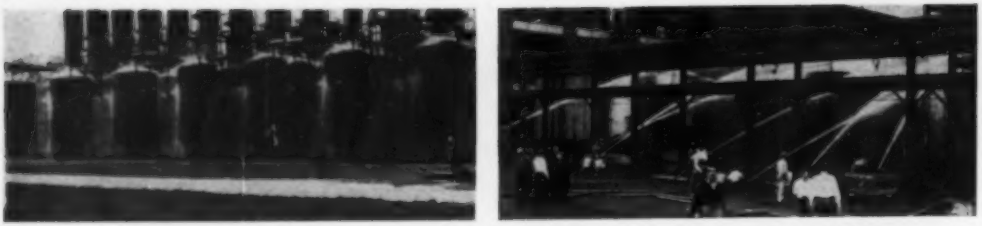


Fig. 3—Water spray protection for tanks, piping and pumps (left) is much superior to hose stream application (right).

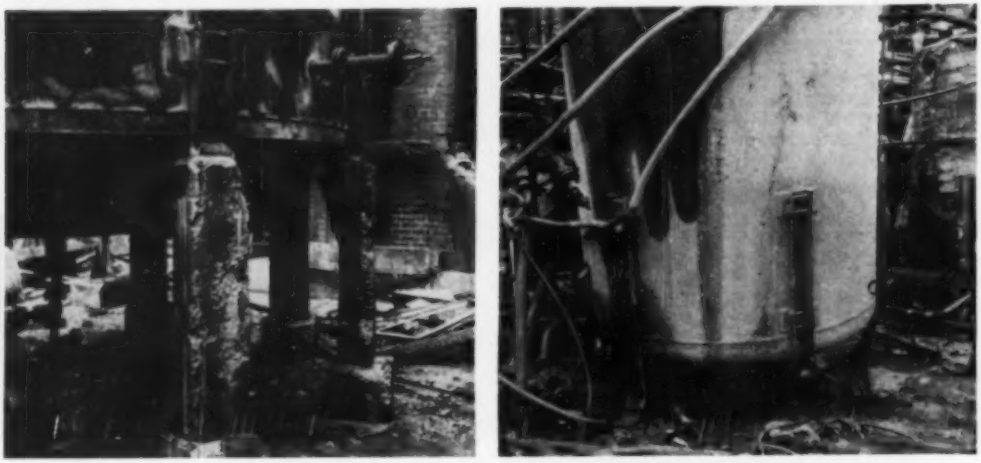


Fig. 4—Severe fire exposure will buckle tank legs (right), while concrete fireproofing will prevent collapse (left).

Many installations, particularly in older plants, require more detailed plans to be formulated for the segregation of equipment. Such details are in general beyond the scope of this article. However, many will be evident from a study of Fig. 1. Generally speaking, poor segregation leads to greater losses, higher insurance rates, or more outlay for extinguishing systems. Table II gives suggested spacings applicable to chemical processing plants which are properly designed for the prevention and control of fire. Where these distances are not adhered to, additional expenditures are required for fire-safe construction and fire protection equipment.

Construction vs. hazards

The design of plant structures should provide for fire resistance in accordance with the severity of the hazards involved. For example, the buildings should be so constructed that they will resist a fire for a reasonably long exposure. Fire resistant construction should be provided for the following:

1. Hazardous occupancies in order to minimize the likelihood of fire spreading throughout a building and doing damage to the building itself.
2. Vital occupancies, such as storage vaults, transformer rooms, electrical substations, laboratories, etc.
3. High-value occupancies where any serious fire would cause excessive property and production loss.

Recommended practice and experience dictate that fire resistant construction should be provided throughout a chemical processing plant. Employees are thus provided a better and safer place to work, where good housekeeping is more easily obtained, morale is higher, and employee relations are better. All of these factors tend to free the individual for constructive fire prevention thinking along operational lines. Further, the best protection is obtained at the lowest costs because greater security is guaranteed against major fires. In addition, maintenance costs are minimized, and lower insurance rates are possible.

Processes within buildings

Geographical situations have considerable bearing on the architectural features of a plant. Where processes are contained within buildings for comfort in operation or for cleanliness of product, added fire protection and control measures become necessary. Segregation of the various occupancies follows the requirements previously mentioned. The building design should provide for explosion venting by means of nonrigid roof construction and free window areas to prevent severe structural damage. Forced air ventilation systems can change the air at a rate sufficient to prevent the formation of flammable vapor-air mixtures. For more hazardous operations, where flammable vapors are continuously released, direct vapor removal systems are necessary.

Vertical structural steel members in multistoried process buildings should be encased in fire-resistant materials to protect them against exposure fires. Horizontal members can be protected with insulation, but automatic sprinklers installed for other reasons are effective and economical for this purpose and are preferred. However, the use of so-called "fireproofing" of horizontal structural members is effective in buildings handling flammable dusts in preventing the collection of dust on otherwise exposed horizontal surfaces. See for example Fig. 1.

Outdoor equipment

In plant designs of the past 20 years, much processing equipment has been moved outdoors for the purposes of both economy and safety. This is particularly true where climatic conditions do not affect operations adversely. A structure consisting of either steel or reinforced concrete is usually provided to support the outdoor equipment. This structure may surround or be adjacent to a small building housing process and electrical controls and auxiliaries. Standard water curtains on exterior walls or inside sprinklers are used to protect the building and personnel against fires in the equipment area. Exposed structural steel will fail in the early minutes of a fire and this damage may result in the release of large quantities of flammable liquids. To forestall such structural failure and the resulting more severe fires, automatic water spray protection of the steel should be provided for in the design. (In this connection see Pamphlet 15 of the National Board of Fire Underwriters.)

Spray vs. insulation

Water-sprayed steel structures are preferred over insulated steel or reinforced concrete because they are less expensive and will provide complete protection for an unlimited period. Processes involving high pressure and unstable compounds are, in many cases, dependent upon auxiliary services for controlling the reactions and pressures through cycling, refluxing, refrigeration, cooling, or pumping-out. It is essential that these services remain intact during fires to minimize further losses. One design feature which will help to achieve this is to extend the water spray protection (Fig. 3) to cover the piping, pumps, and valve manifolds where they can be directly exposed to fire.

Spray for supports

Skirts supporting equipment containing flammable materials can be protected economically with water sprays to prevent failure. However, tank legs at ground level may be encased in concrete to prevent failure since insulation is less expensive in such cases than water spray protection. Fig. 4 shows the effectiveness of such protection. Vessels containing unstable compounds should be protected from fires by water spray. Often similar protection is justified for stable high-vapor-pressure materials.

Disposal drainage

Disposal drainage is a necessary adjunct in all processing and storage areas to prevent fires from spreading by the spillage of flammable liquids. In sprinklered buildings, normal floor

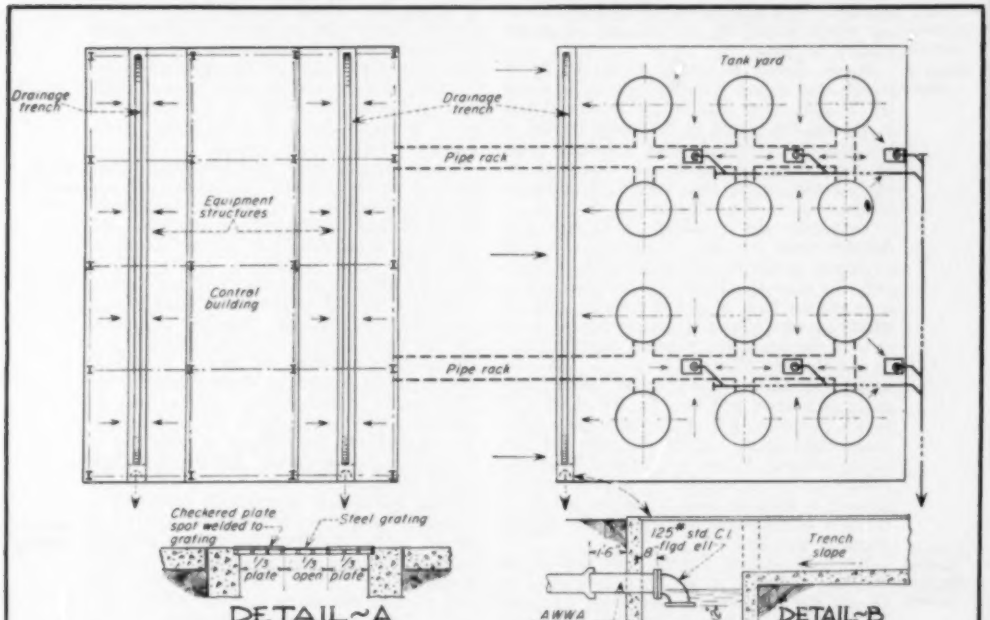


Fig. 5—Drainage system for fire water and process spillage with detail of drainage trench cover at (*A*) and of a trapped sump in trench or tank yard at (*B*). Note that the building floor pitches to drain to the equipment structure trenches. The tank yard is pitched to drain to the sump locations shown, which are located on the assumption of water spray protection on the piping and supports between tanks. Drains and sewers are sized to handle possible process spillage as well as fire water discharge.

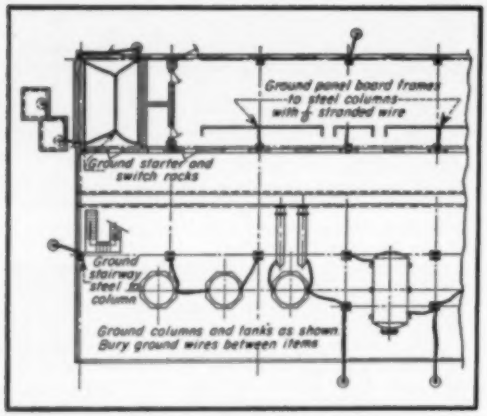

Ground panel board frames to steel columns with #4 stranded wire
Ground starter and switch racks
Ground stairway steel to column
Ground columns and tanks as shown
Bury ground wires between items

Fig. 6—Grounding system for a chemical unit showing grounding of electrical equipment, tanks and columns.

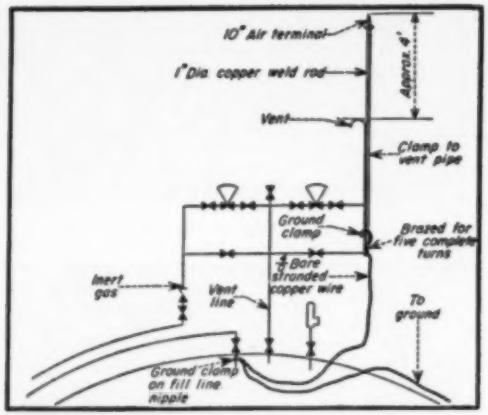


Fig. 7—High vent on a flammable liquid tank equipped with a lightning rod. For inert gas system see Fig. 11.

drainage is generally adequate for the levels above grade. If floor drains are not provided, wall scuppers capable of handling 0.10 gpm. per sq. ft. of floor area should be considered. Openings between floors, and between fire areas handling flammable liquids, should be curbed, collared, or sealed. Outside equipment areas may be drained by outlets provided in piping trenches. Where these are not available, drainage sumps should be provided and all grades pitched to them.

Design of drains

Drains should be provided also in dyked storage areas to permit surface water to be drawn off. Shutoff valves may be desirable for drains to prevent the spread of flammable liquids or loss of a product of high value. All drains must be trapped for segregation of areas and extinguishment of the fire. Suitable drainage arrangements are illustrated in Fig. 5.

To prevent the spread of fire through pipe trenches from one area to another, or from an outside processing area to the inside of buildings, fire stops should be installed after piping is in place. Fires in piping trenches may be effectively controlled and extinguishment made easier if the top of the trench is two-thirds covered with steel plate, as in Fig. 5, with the center third open. This covering provides adequate ventilation and area for the relief of a trench explosion, and at the same time minimizes combustion, reduces exposure and aids extinguishment. Where quantities of flammable liquids are being handled, it is good practice to curb or dyke the area to confine and direct the flow of accidental spillages to the disposal drains or trenches.

Cutting electrical hazards

Electrical ignition sources cause fires in the chemical industry as in other industries, although the percentage is low when compared with nation-wide averages. Ignition sources of electrical nature are minimized in numerous ways which are prescribed generally by the regulatory codes.

Any equipment for the processing, handling, or storage of flammable liquids should be adequately grounded (electrically bonded to ground) for the dissipation of electrostatic charges. Fig. 6 shows typical bonding arrangements. The nature of static electricity is such that proper safeguards should be maintained against the possibility of its build-up and discharge in the presence of hazardous materials. Experience with static electricity is quite extensive and many data have been published. It is known that certain flammable vapor-air and dust-air mixtures can be ignited by static sparks of low energy. It is also known that static is generated in fluid and gas transfers and in the handling of resins, textiles, paper, coating materials, and synthetic fibers. It is necessary to avoid the accumulation of static charges where flammable materials are present.

How to dissipate static

Maintaining materials and processing equipment at ground potential is desirable and can be accomplished in many instances through accepted methods of bonding and grounding. All vessels in flammable-liquid service should be filled from below the surface, or they should be blanketed with oxygen-free vent gas. Humidification is helpful in mitigating static charges on hygroscopic materials. Patented equipment for the neutralization of static charges also is commercially available. In addition to the fire and explosion hazards of static electricity, the efficiency of manufacturing processes may be affected adversely, quality of the product may be impaired, and the presence of static may be demoralizing to personnel. Any design features which eliminate this hazard are good fire prevention and should definitely be considered.

Safety vs. lightning

Induced and direct lightning discharges have caused serious fires and explosions. However, methods of protecting equipment against these discharges are described in the regulatory codes and are used extensively and successfully. Like static charges, they can be dissipated to the ground through systems of bonds and ground connections covering all of the process equipment and surrounding structure. Non-metallic structures also require lightning rods systems (See Fig. 1). During electrical storms, induced discharges may ignite vented flammable vapors.

This may be avoided by extending a grounded metallic body above the actual vent point, as in Fig. 7. Or a permanently piped fire-extinguishing medium may be in order. Designs which consider protection against lightning are particularly desirable from the standpoint of fire prevention.

Follow Code recommendations

Electrical apparatus and services normally considered safe for ordinary occupancies have been proven unsafe for installation in locations where flammable gases, liquids, and dusts are handled. With the growth of the petroleum and chemical industries, electrical equipment and the methods of using it have been developed to such an extent that plant designers are now able to prevent many fires and explosions previously attributed to electrical sources. Electrical installation requirements for hazardous areas are presented in the National Electrical Code which is accepted widely in industry and by civil authorities. Electrical equipment which has been tested and found suitable for service in hazardous areas, as defined by the Code, is listed by the Underwriters' Laboratories, Factory Mutual Laboratories, and the U. S. Bureau of Mines. The experience of these groups, coupled with that of the industry, now forms a firm basis for safe electrical design in chemical plants.

Electrical equipment must be suitable for the hazards, it must be properly installed, and it must be carefully maintained if fires and explosions are to be minimized. The authority inforcing the Electrical Code judges when apparatus and wiring is subject to hazardous conditions. Often the question arises as to whether or not a specific occupancy or area of a chemical processing plant is hazardous and, if so, to what degree. Experience indicates that any area or occupancy containing flammable materials is hazardous. Experience further indicates that the degree of hazard is dependent in part upon other design considerations, process operations, and the maintenance of the electrical equipment.

Use safe electrical equipment

On the basis of the industry's fire experience, certain electrical practices, predicated on a maximum of safety with reasonable economy, have been found effective. For example, vapor-tight incandescent lighting fixtures equipped with heat-resistant globes (for protection against thermal shock) are used throughout processing areas. However, in confined areas where flammable vapors are present frequently or continuously, explosion-proof fixtures should be used. Where fluorescent fixtures are desired in processing areas, only the explosion-proof type is recommended. Use of explosion-proof telephones is an accepted practice in hazardous areas. This policy also applies to motors, except that large synchronous motors may be equipped for pressurizing the collector rings with an inert gas or dry air, as in Fig. 8. It applies too to exciters, pilot lights, signal circuit protective devices (breakers), manual switches unless oil immersed, and motor driven horns or howlers.

Service receptables (for 110-volt service) can be vapor-tight or water-tight, and do employ an interlocked switch that can be operated only when the unit is closed to the surrounding atmosphere. Service receptacles for voltages in excess of 110 volts should be of the interlocked plug and switch type, explosion-proof, suitable for indoor and outdoor service. Water-tight signal buzzers are installed on the same basis. Unapproved starters, switches, circuit breakers, and relays should be either located in segregated switch rooms, hermetically sealed where practicable, or enclosed under positive pressure of an inert gas or clean, dry air.

Where to put transformers

Transformers using inert coolants may be located outdoors within hazardous areas, adjacent to buildings on external building walls, or on roofs—although the last-named location is not desirable. Fused cut-outs, required in these transformer installations, must be oil-immersed. Transformers using flammable coolants must be reasonably spaced from hazardous areas and be provided with drainage, curbing, fire extinguishing systems, or other protection as may be justified by the size and importance of the installation, and the exposures involved. Electrically actuated instruments and their components are not generally approved for use in hazardous areas. Manufacturing advancements are being made, however, and when particularly hazardous instruments must be located in the chemical manufacturing area, special housings should be supplied for all spark- and heat-producing parts. These housings are maintained under a positive pressure of an inert gas or dry air, as in Fig. 9.

Don't overload circuits

The design of an electrical circuit requires thorough consideration of both economy and fire prevention. Many fires of electrical origin result from overloading, with resultant overheating. Electrical apparatus should be carefully selected for a given duty. Its supply circuit, and in some cases the apparatus itself, should have protective devices that prevent dangerous overloading. Process requirements may place excessive demands on electrical apparatus, particularly where cyclic loads are involved. A good design will anticipate the overloading of electrical apparatus and provide for its safe use and continued operation. During periods of abnormality, electrical apparatus may be forced beyond rated limits, even to the point of failure, unless special emphasis is given to this danger in the design of the installation.

Interruption of power to a continuous processing unit, either in part or entirely, can be costly and hazardous. Repair or replacement costs for electrical apparatus are generally nominal when compared with the cost of shutting down a processing unit. Where it is impracticable to prevent these failures, other fire prevention and control features, as described elsewhere in this article, are required.

Safety in process design

Well conceived plans for the prevention of fire are of primary importance in the design of all chemical processing equipment. Successful plant operation depends on continuous production and the design should recognize inherent weaknesses which may lead to failure. These may be difficult to detect, owing to the lack of experience with specific reactants, substitution of construction materials, or unanticipated demands that result from process alterations.

Requirements for the basic designs of chemical processing equipment are presented in estab-

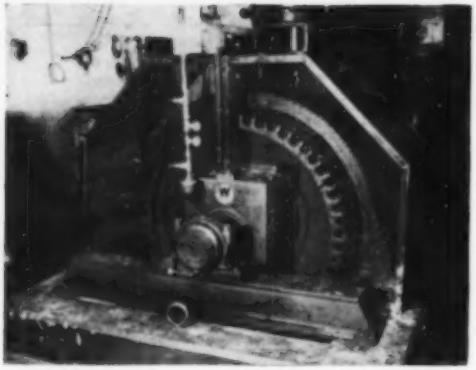


Fig. 8—Large synchronous motors can be equipped with pressurized inert gas housings around the collector rings.

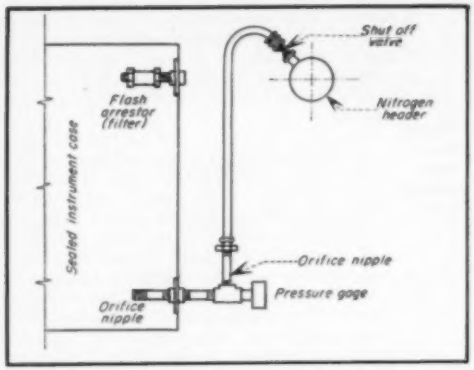


Fig. 9—Instrument housings can be purged with nitrogen to exclude flammable gases from ignition sources within.

lished codes that frequently are altered in accordance with experiences acquired. The designer is concerned primarily in specifying an economical system or piece of equipment, suitable for a specific chemical operation. Naturally, this involves problems of temperature, pressure, corrosion, erosion, metal fatigue, and other considerations, such as relief from overpressure or vacuum. These basic design requirements, coupled with the experience of the designer and operator and the nature of the chemicals encountered, actually determine the requirements for the final design. Reported cases of equipment failure from corrosion and collapse appear in Fig. 10, and causes of failure in Table III.

Causes of failures

Equipment records accumulated over a period of years and summarized in Table III show that the predominating factors in about 80 percent of the cases of mechanical failure of chemical processing equipment are, in this order: corrosion and/or erosion, exceeding equipment limitations, inadequate vents, metal fatigue, faulty design, and excessive localized stresses. Defective materials, inept workmanship, and inadequate servicing are responsible for a major part of the remaining 20 percent. When attention is given to these features and allowances made in the design, the number of failures and fires usually considered inherent in a process can be minimized. The various codes and the literature present a great deal of information concerning the behavior of metals and other materials of construction under general conditions. Where new processes and products are met, or standard design operating conditions are altered, the behavior of the construction materials may also change. Periodic inspection and test of equipment under continual use, together with laboratory determination of the properties of the materials, is then essential to safe operation. This also provide further experience that will serve as a basis for future designs.

Choose materials for safety

In addition to being designed so as to help prevent failures, processing equipment must be constructed of materials that will prevent undesirable contamination of the product or the formation of unstable compounds. It is true, of course, that some products themselves are unstable and may react with great violence. At times, investigation of stability and other properties in advance is necessary to evaluate and control hazards and thus enable intelligent design of the plant to be made.

A good design will provide for the processing, handling, and storage of flammable materials in closed systems which are safe under the conditions involved. Where experience indicates that the conditions may exceed the designed limitations, other safety features to control the process—or fires which may result—should be incorporated in the equipment. Excess-flow valves in discharge lines, check valves in fill lines, and automatic shutoff valves in gage glass columns are included in this category. Some of these are illustrated in Fig. 11.

Overpressure relief

For some applications equipment can be designed and constructed to withstand the maximum pressures which might be developed. In other cases, the cost of this type of equipment becomes prohibitive and the need arises for protection against excessive overpressure or vacuum. Safety valves will generally provide adequate relief. Where experience indicates that rapid rates of pressure rise and high pressures may be encountered, rupture diaphragms are used also. Emergency relief devices should be sized for the condition of fire exposure, which is usually the worst condition. (See Venting of Tanks Exposed to Fire, by James J. Duggan, C. H. Gilmour, and P. F. Fisher, *Nat. Fire Protection Assn. Quart.*, October 1943.)

Since there are limitations in designing equipment to prevent failures and fires, other safeguards are necessary. These may be included under the heading of "process design," or "process control."

Use of oxygen-free gases

Oxygen-free gases are used to improve the safe and efficient processing, storing, and handling of flammable materials. Inert gases, such as nitrogen and carbon dioxide are effective for maintaining non-explosive atmospheres, preventing oxidation of products, and purging. Flammable gases are effective in diluting unstable vapors. The use of oxygen-free gases will assure an added degree of safety by minimizing

conditions conducive to fires and explosions. These oxygen-free gases, both flammable and non-flammable, help to eliminate flammable vapor-air mixtures within a system and to dilute otherwise dangerous vapors. The use of non-flammable gases is more desirable. Inert gases are also used to transfer materials to and from equipment, thus maintaining closed systems. They are of particular value for excluding oxygen when relieving vacuum in equipment. (See again Fig. 11.)

Controlled vent systems

Controlled vent systems employing an inert gas are also important aids in preventing fires and explosions by minimizing the amount of flammables released. In addition, they afford a means of recovering valuable products. Processing equipment or systems in which inert atmospheres are maintained are relatively non-hazardous. During normal operation, pressures may be maintained automatically by adding or releasing the inert medium as in Fig. 11, either to the atmosphere or to recovery equipment. With proper design considerations, the use of such vent systems may be extended beyond normal operating conditions so as effectively to prevent equipment failures.

Hazards of poor venting

Inadequate venting contributes to a large percentage of equipment failures, many of which result in fires. However, venting systems, like equipment, have limitations. For emergency and fire exposure conditions, safety valves, rupture diaphragms, or other forms of relief devices must be provided as protection against overpressure. Such apparatus releases flammable vapors, and the actuation of non-closing devices leaves the vessel contents exposed to the air. Equipment located within a building should have the relief device discharge to a safe point outside. When the amount of discharged vapors is large and thereby creates an undue hazard, the vapors should be burned off in a remote flare or pit.

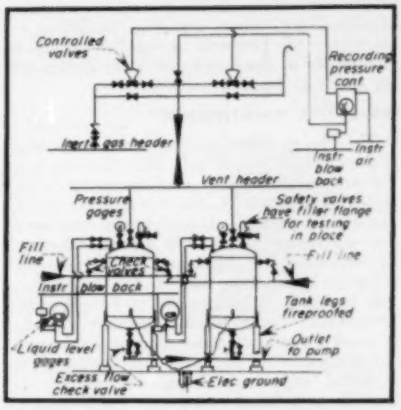
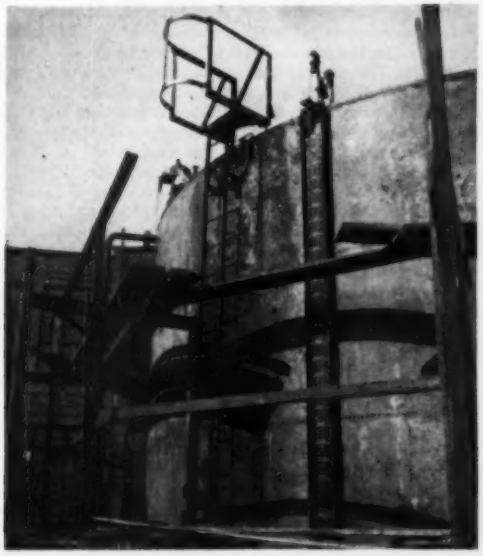


Fig. 11—Inert gas vent system for storage tanks and equipment handling high-volatile flammable liquids are controlled to release vented vapor to atmosphere or draw in inert gas if pressure becomes negative. Other fire-prevention methods are also shown.

Process instrumentation

Perhaps the most important phase of process control is instrumentation. Processes may be controlled manually when the conditions are known by the operator through indicating or recording instruments. The degree of control so obtained is then dependent upon the response of the operator. If abnormal or complex conditions exist that may lead to uncontrolled chemical reactions or other hazards, instrumented controls are necessary. Controls may be arranged for regulating all process conditions.



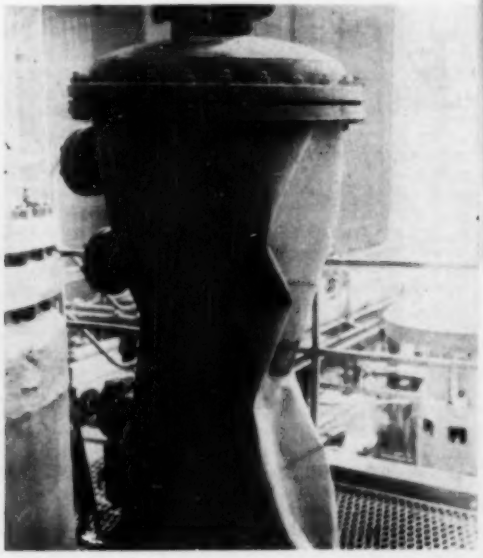


Fig. 10—Two of the most prevalent causes of equipment failure are corrosion (left), and exceeding of the design limitations (right).

When the nature of the process is extremely hazardous, e.g., when operating conditions require that the products be handled within or just outside of the flammable range, continuous gas analyzers are also necessary.

PREVENTIVE MAINTENANCE

Maintenance is a must

The design considerations that have been discussed will help to minimize the effects of the human element by eliminating conditions that lead to accidents, and hence sometimes to fire and explosions. However, the success of the prevention program is greatly influenced by maintenance. Machinery and equipment must be operated in the manner for which it was designed, if failures are to be prevented. Continuous operation, as in many chemical processes, does not make for easy or frequent maintenance. To overcome this handicap, operational experience should be carefully recorded, past failures analyzed, and a periodic test and inspection schedule established. Should these inspections indicate that operational demands are approaching or exceeding the design limitations of the equipment, corrective measures should be undertaken before failures occur. Since conditions vary with different plants and with different processes, complete service records are essential to any preventive maintenance program.

Maintenance work performed on processing equipment can itself introduce fire hazards. Certain procedures for purging and cleaning equipment prior to operations should be mandatory. Work that creates sources of ignition, such as welding, soldering, burning-out operations, or the use of spark-producing tools must be controlled carefully to minimize the hazards and prevent fires.

Maintenance of fire-prevention and control facilities is not to be overlooked. These facilities are adjuncts to the process system, and any failure of one may lead to failure of the other.

Good housekeeping

Good housekeeping throughout the plant is an important element of fire prevention. Rubbish and waste materials initiate a large number of fires through spontaneous heating. They also afford fuel for the spread of incipient fires. When it is impracticable to remove waste promptly, it should be kept in covered metal receptacles and removed from hazardous areas daily. Good housekeeping maintains order and cleanliness, instills pride and care in the personnel, eliminates personnel hazards, and removes obstacles which hinder control and extinguishment of fire. A summary of the predominant causes of a large number of chemical plant fires appears in Table IV.

EDUCATING THE INDIVIDUAL

Education pays off

The science of fire fighting has received increasing attention in recent years from the general public as a result of numerous disastrous fires. Excellent programs have been developed for preventing and protecting against fire, but the success of any program is affected by the attitude of those it serves. Complacency, where fires and explosions are concerned, must be viewed with apprehension.

Table III—Predominating Factors in 699 Mechanical Failures of Equipment and Machinery (14 Years)

Cause	Number	Percent
Corrosion and erosion	347	49.6
Exceeded design limitations	81	11.6
Faulty vents	80	11.4
Metal fatigue	50	7.1
Defective fabrication	43	6.2
Inadequate servicing	30	4.3
Faulty design	20	2.9
Excessive localized stresses	17	2.4
Defective material	15	2.1
Excessive wear	8	1.1
Miscellaneous	8	1.1

Table IV—Predominating Initial Factors in 1,011 Chemical Plant Fires (11 Years)

Cause	Number	Percent
Leaks	213	21.1
Ordinary combustibles	180	18.7
Hazardous solids	140	13.8
Operating difficulties	69	6.8
Mechanical failures	62	6.1
Venting	59	5.8
Accidental spillage	50	4.9
Insulation	43	4.2
Misel. electrical equipment	41	4.1
Human element	38	3.8
Electric wiring, cords, lamps	32	3.2
Cleaning equipment	26	2.6
Electric motors	15	1.5
Open containers	11	1.1
Miscellaneous	10	1.0
Vessel emptying	7	0.7
Dust-air mixtures	5	0.5

Investment in intangible fire prevention and control features is often difficult to justify and their need is recognized only through experience. The design engineer, management, and the builder must work together to evaluate properly the inherent hazards of equipment and processes. Operation, inspection, and maintenance groups also must work together to reach production goals within the limitations of the design. For continued production, safe from fire, all these groups must cooperate in re-evaluating the inherent hazards of any variations in the process.

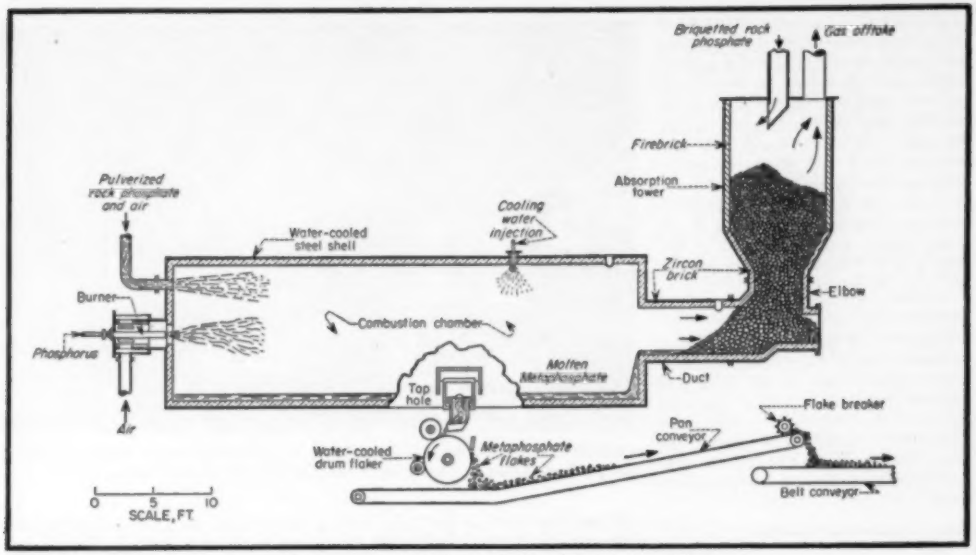
Minimizing human failures

Education of the individual plays an important role in any fire-prevention program. This is particularly true in chemical processing plants. Any mechanical or electrical contrivance is subject to failure in spite of efforts to prevent breakdown. In the case of the individual, he too can fail. But his failures can be minimized. Chemical process operators must be thoroughly instructed in the process and its operation. For best efficiency, a description of the process and all operating instructions should be available in clear, easy-to-understand, concise terms. Also, a listing of abnormal conditions and corrective measures to be applied should be handy. Simplified control allows more proficient operation. Personnel supervision should be competent and alert.

What is effective training

An effective fire-prevention program should include basic training in the principles of fire and fire extinguishment for everyone. This develops an awareness that prevents many fires and facilitates quick extinguishment of a large percentage of those that have already started.

Giving time and effort to fire prevention will result in lower fire damages and increased dividends. However, it must be remembered that a fire-prevention program will deteriorate if those charged with its execution do not maintain constant vigilance. For these reasons constructive efforts should be encouraged and rewarded.



INNOVATIONS are (1) elbow support for lump phosphate charge; (2) Phosphate injection. These mean . . .

Improved Fertilizer Plant Design

Burns liquid phosphorus more efficiently.

Catalyzes, controls, P_2O_5-rock phosphate reaction.

Produces more than twice as much calcium metaphosphate.

L. D. YATES, L. F. ROY and R. S. MELINE

In 1937, TVA engineers were proud of their new calcium metaphosphate unit which was capable of producing 2 tons per hr. of metaphosphate fertilizer. Not long ago, they put to work a new unit capable of pushing production up to almost 5 tons per hr.

They did it by revamping the basic design of the combustion unit, heart of the process.

In brief, the process, old and new, consists of burning liquid phosphorus, reacting the resulting P_2O_5 with rock phosphate to produce metaphosphate.

The TVA men had a good reason for working out a new unit, building a new plant around it.

Problems and Answers

In the old installation, the lump phosphate charge was held in an absorption tower where it reacted with the P_2O_5 formed in combustion. An elevated, water-cooled grate supported the lump phosphate. This grate was found to be unsatisfactory because it broke down frequently—much too frequently.

With such an Achille's heel, authority chiefs decided to improve the unit's design, overcome the difficulties.

Work was begun before the war, halted during the conflict, finished in 1949.

The plant has two main features that do its engineers credit. (1) Elimination of the troublesome grate, substitution of a steel elbow at the bottom of the absorption tower (see cut). (2) Injection of pulverized rock phosphate through a standard 5-in. pipe into the combustion chamber. In the old process, only the lump charge in the tower reacted with the P_2O_5. The new design has the advantage of a double reaction. The catalyzed (by reason of the fine particle size and injection mixing) fines at one end of the combustion chamber, the slower lump charge at the other. Thus, not only is the increased production capacity capitalized on, but closer control of the ratio of P_2O_5 to CaO in the final product is possible.

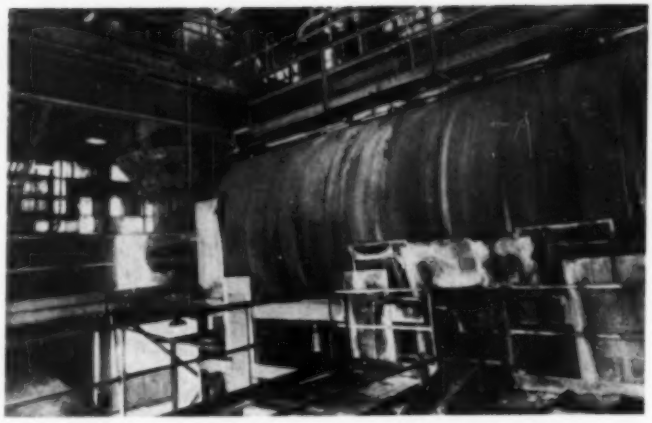
TVA has built a demonstration plant at Wilson Dam, Ala., embodying these and other improvements. It has been operating for several months, producing about 115 tons a day of calcium metaphosphate fertilizer.

Details of Construction, Operation

In this plant, the lump phosphate charge is supported on a 90-deg. steel elbow forming the bottom of the vertical bosh-type absorption tower. This elbow is 4 ft. 9 in. in diameter, has a radius of turn of 3 ft. 6 in. It is connected to the phosphorus combustion chamber by a horizontal cylindrical duct into which the lump charge extends as far as its angle of repose allows. Rock phosphate, ground to about 80 percent minus 200 mesh (Tyler), is blown continuously into the phos-

L. D. YATES, L. F. ROY, and R. S. MELINE are members of the Development Section, Division of Chemical Engineering, Tennessee Valley Authority, Wilson Dam, Ala.

phorus combustion chamber and there reacts with P_2O_5 while suspended in the chamber atmosphere. The agglomerated rock phosphate in the tower serves to remove from the gas most of the P_2O_5 that escapes reaction in the chamber. The elbow, tower bosh, and duct are lined with 4½ in. of zircon brick and the upper part of the tower is lined with firebrick. The external surfaces of the tower, the elbow at the inside radius, and the top half of the duct—all of these pieces of equipment are water cooled.



COMBUSTION chamber is lined with 6 in. of zircon brick, water cooled on the outside surfaces. Elbow and tower are at left, tap hole and chute, lower right.

FEATURES

Other novel features in the design of the new plant are: (1) an internally water-cooled rotary drum flaker for cooling the molten product and (2) the use of a water spray inside the combustion chamber to control the temperature. The plant can be operated with or without a fine phosphate feed.

The Combustion Chamber

The combustion chamber is a horizontal cylindrical steel chamber, lined with 6 in. of zircon brick, water-cooled on the outside surfaces. Molten phosphorus is fed to the chamber by means of a water displacement system similar to that described in a previous article on phosphorus combustion.[1] The phosphorus is burned at a constant rate.

In order to maintain the indicated temperature of the combustion chamber within the range of 1,900 to 2,000 deg. F., a small amount of water is sprayed into the top of the chamber at a point near its center. The water is vaporized and passes through the tower with the combustion gas. Control of the rate at which water is sprayed into the combustion chamber is a means of controlling the indicated temperature in the chamber. The 1,900 deg. figure is the lowest temperature at which the product is fluid enough to flow readily through the trough. The upper figure, 2,000 deg., was chosen to avoid unnecessary wear of refractories and because there was some evidence that temperatures above 2,000 deg. F. resulted in poor operation of the absorption tower. The phosphorus burning rate could be increased without raising the chamber temperature by increasing simultaneously the amount of water sprayed into the chamber. Three gallons per minute was required for a phosphorus burning rate of 2,000 lb. per hr. and 7 gpm. for a phosphorus rate of 2,400 lb. per hr. When the amount of water exceeded 7 gpm., localized cooling of the metaphosphate pool occurred and this interfered with tapping.

Several types of agglomerated phosphates were tested as tower charges in the pilot-plant work. Briquetted Tennessee phosphate, made from phosphatic matrix and washed phosphate sands, proved suitable. This particular phosphate, containing 18 percent silica or less, is a very satisfactory lump charge. Operation can be maintained on charges that contain from 18 to about 22 percent silica, but only with some difficulty because of the formation of a viscous melt in the tower. Practical limit of silica content is believed to be about 22 percent of lump charge.

THE PHOSPHATE FINES

A convenient source of fine phosphate is Florida phosphate of the type used in the production of concentrated superphosphate at the TVA plant. This material is ground to about 80 percent minus 200 mesh. The fine phosphate is conveyed pneumatically from the pulverizers to a storage bin at the metaphosphate plant. From there it is conveyed by a screen to a weighfeeder.

The only fine phosphate feed used to date in the new plant has been the ground Florida phosphate. However, pilot-plant tests showed that Tennessee phosphate containing less than about 18 percent silica is a suitable charge when ground to about 80 percent minus 200 mesh. When a fine phosphate feed containing more than this amount of silica was used in the pilot plant, a viscous product was formed and this product was difficult to tap from the chamber.

The fines are blown into the phosphorus combustion chamber by means of a venturi-type injector mounted in the end wall above the phosphorus burner. Air at 25 psi. is used for blowing the fines and also provides part of the air needed for combustion. Most of the calcium metaphosphate particles formed impinge against the walls of the chamber and drain into the product pool in the bottom of the chamber. However, some of the particles escape impingement in the chamber, and about 20 percent of the P_2O_5 escapes reaction in the chamber. These particles and the P_2O_5 pass into the lump charge in the absorption tower. There the metaphosphate particles are collected by impingement and most of the P_2O_5 reacts with the lump charge to form more metaphosphate.

This drains into the combustion chamber to join that formed initially.

TAPPING

Product is tapped continuously from the combustion chamber through a water-cooled sleeve onto a rotary drum flaker that is internally water-cooled.

This type of equipment has considerably more capacity and requires much less space than the internally water-cooled rotary cooler that was used in the old plant.[2]

Flow of molten product from the chamber is regulated by varying the position of a water-cooled plug inserted into the sleeve so that the level of product in the chamber gradually falls until the combustion gas escapes through the taphole. The flow then is decreased markedly or stopped altogether for a few minutes until the level in the chamber again is built up. This procedure also controls the level of molten metaphosphate in the chamber, keeping it between 1 and 2 ft.

The metaphosphate adheres to the drum surface until it is removed in the

AVERAGE RESULTS	
Phosphorus burning rate, lb./hr.	2,000
Combustion chamber roof temperature, deg. F.	1,900
Combustion chamber pressure, lb./sq. in.	1.3
Briquetted phosphate charge, lb./hr. (CaO balance)	1,720
Fine phospate charge, lb./hr.	3,880
CALCIUM METAPHOSPHATE	
Production rate, lb./hr.	9,610
P_2O_5/CaO mole ratio	0.99
Total P_2O_5, percent	64.4
Citrate soluble P_2O_5, percent	63.8
Loss of P_2O_5 in stack gas, percent of liquid phosphorus burned	0.3

RESULTS and data for a 4-week period of continuous operation. Fine phosphate was used to supply 69 percent of the phosphatic raw material in the plant.

form of brittle flakes by a scraper blade. The flaked material is ground to pass a 10-mesh Tyler screen (50 percent −35 mesh), and about 5 percent of ground limestone is added to prevent caking.

Results of 4 Weeks Testing

Data and results from a typical 4-wk. period of continuous operation using fine phosphate to supply 69 percent of the phosphatic raw material are shown (see table above). Liquid phosphorus was burned at a rate of 2,000 lb. per hr. Daily production was about 115 tons of calcium metaphosphate containing 64.4 percent P_2O_5 of which 99 percent was citrate soluble by the AOAC procedure (minus 35-mesh material is subjected to continuous agitation in neutral ammonium citrate solution). Loss of P_2O_5 in the waste gas from the plant amounted to 0.3 percent of the liquid phosphous burned. Combustion chamber pressure was in the range of 1 to 2 psi.

Operation of the plant has shown that the grateless lump charge support is satisfactory. Occasionally, a small amount of lump charge slides into the combustion chamber, but does not interfere with operation.

Wear of the refractory at the charge support is moderate, and very little repair has been required at this point. The calcium metaphosphate product is easily cooled to brittleness on the rotary drum flaker, and control of tapping rate through the use of the water-cooled plug is satisfactory.

MOLE RATIO OF PRODUCT

In the old plant in which only lump rock phosphate was used, it was difficult to control the P_2O_5/CaO mole ratio of the product. This was also true in the new plant when fine phosphate feed was not used. It is desirable to control the ratio within the range of 0.95 to 1.00. As the ratio decreases, the proportion of high-cost liquid phosphorus to low-cost rock phosphate also decreases. However, when the ratio falls below about 0.95, citrate solubility drops off rather sharply. As the mole ratio rises above 1.0, hygroscopicity increases rapidly. In the fines process, this ratio can be controlled rapidly by adjusting the fines feed rate. Although the plant has been operated for only a short period without fine phosphate feed, it appears that the use of fine phosphate allows somewhat higher phosphorus burning rates to be used and tends to decrease the loss of P_2O_5 in the waste gas.

Problems, Improvements

Although the rate of decrease in refractory thickness at the lump charge support has not been high, wear of the combustion chamber lining at certain points has been rather severe. The pilot-plant work indicated that the chamber would need relining after 1 to 2 years, but present operations indicate that the areas of severest wear may need replacement more frequently and other areas less frequently. However, more data are needed to establish definitely the rate of refractory replacement necessary.

TEMPERATURE LIMITS AND COOLING

Temperature was the chief factor that limited phosphorus burning rate and, hence, production capacity. The maximum rate at which water was sprayed into the combustion chamber to control the temperature could not be increased because of the localized cooling effect. It is thought that by spraying a lesser amount of water into the chamber at each of several points, this objectionable localized cooling could be avoided and the production capacity of the plant raised. This procedure will be attempted when more experience in operation has been gained.

WASTE CONTROL

In the calcium metaphosphate process, between 80 and 90 percent of the fluorine present in the rock phosphate raw material is volatilized and escapes in the waste gas leaving the absorption tower. Plans are under way for installing equipment to remove most of this fluorine from the waste gas and to recover it as impure calcium fluoride, using either a dry limestone-packed tower similar to that installed at TVA's fused tricalcium phosphate plant[3] or a limestone slurry scrubbing system.

Product

Last, but not by any means least, a brief mention of some characteristics of the product is in order. Since this article has dealt primarily with the engineering aspects of plant design, the reader who is interested in learning more about the properties of calcium metaphosphate is referred to the literature. However, it should be pointed out that calcium metaphosphate is a concentrated phosphate fertilizer containing 60 to 65 percent available P_2O_5. Extensive agronomic tests in the Tennessee Valley, where the soils are predominately non-alkaline, show that it is substantially equivalent to superphosphate in fertilizer effectiveness.[4] For more specific information on the chemical and physical properties of calcium metaphosphate, the reader is referred to the references.[5, 6, 7]

ACKNOWLEDGMENT

G. M. Blouin, G. C. Hicks, G. G. Patterson, and W. B. Williams assisted in technical supervision of the preliminary operation of the plant.

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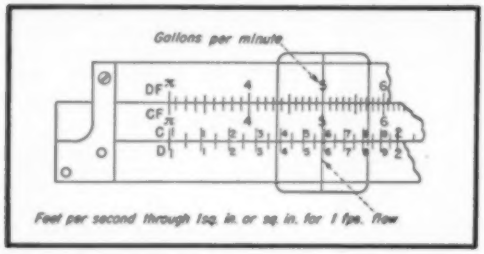
The Plant Notebook

Edited by Theodore R. Olive



Quick Conversions for Flow Quantities and Velocities

FRANK LERMAN, *Director, Bio-Engineering Div., VioBin Corp., Monticello, Ill.*

★ **April Contest Prize Winner**

In pipe sizing or velocity determinations for liquid flow, one frequently knows the gallons per minute flow but must calculate the velocity of flow through a given cross-section area of conduit; or instead must determine the required cross-section of conduit for a specified velocity.

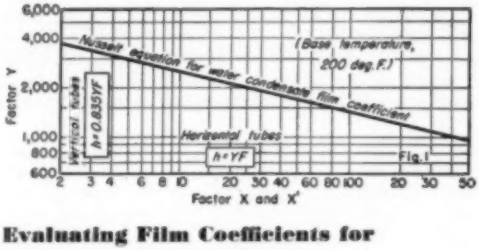
Such calculations can be rapidly done on a slide rule by merely dividing the value in gallons per minute by π. This gives a value which is a close approximation to either: (1) the velocity in feet per second at which the gallonage will flow through a conduit of 1 sq. in. cross-section, or (2) the square inch cross-section required for the given gallons per minute to flow at 1 fps. velocity. Dividing (1) by the square inch cross-section of a given conduit gives the velocity in feet per second through this conduit. Dividing (2) by a desired velocity gives the square inches cross-section of conduit required to obtain that velocity.

On duplex-type slide rules which have the *DF* scale, the division by π is rapidly done by setting the indicator index of the glass runner at the gallon per minute value on the *DF* scale and reading the value under the indicator index of the *D* scale.

Thus, for 5 gpm. liquid flow set on the *DF* scale, read directly below on the *D* scale either 1.59 fps. through 1 sq. in. cross-section, or 1.59 sq. in. cross-section for 1 fps. velocity. If a 2-in. pipe of 3.36 sq. in. internal cross-section is available to move the given gallonage, the flow velocity is obtained by dividing 1.59 by 3.36 sq. in., giving 0.474 fps. flow. Also, if a flow rate of 3 fps. is desired in moving 5 gpm. of liquid, divide 1.59 by 3 to give 0.53 sq. in. of conduit cross-section required.

The actual conversion factors for the gallons per minute are 231 cu. in. per gal. ÷ (60 sec. per min. x 12 in. per ft.) = 1/3.117, which is within the 1 percent slide rule accuracy for the factor $1/\pi$ that is used.

Conversely, one can also determine gallons per minute flow from flow velocity by expressing the velocity in terms of feet per second through a 1 sq. in. conduit or square inches of conduit for 1 fps. flow, then setting this value on *D* and reading gallons per min. on *DF* directly above.



Evaluating Film Coefficients for Single Condensing Vapors

A. DEVORE, *Chemical Engineer and Rating Dept. Head, Davis Engineering Corp., Elizabeth, N. J.*

In evaluating the film coefficient of heat transfer for single condensing vapors, it is standard practice to use the alignment chart of Chilton, Colburn, Genereaux and Vernon.[5,6] The location point for water is based on liquid thermal conductivity values which increase linearly with temperature.[6] However, more recent data of Timrot and Vargaftik[4] show that *K* goes through a maximum. Jakob[3] recommends that these later data be used.

The term for thermal conductivity appears to a higher fractional power in the temperature term of the Nusselt equation than does any other physical property. Hence the error in computing film coefficients becomes considerable at higher film temperatures. For example, the value of *K* computed from the equation in Ref. (2) $K = 0.31 + 0.00048t$ is 0.502 Btu./(sq. ft. hr. deg. F./ft.) at $t = 400$ deg. F. However, the plot of the data of Timrot and Vargaftik shown as a dashed line in Fig. 2 gives a value of 0.381 Btu./(sq. ft. hr. deg. F./ft.) and the error in using

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★ May Contest Prize Winner

"Container Discharger Is Simple, Safe and Easily Transported to Point of Use."

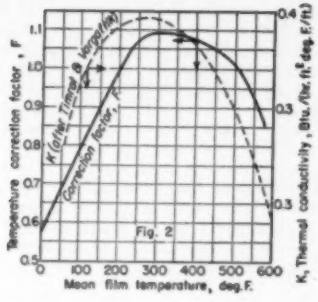
A prize of $50 in cash will be awarded to W. L. Patton, Chambers Works, E. I. duPont de Nemours & Co., Penn's Grove, N. J. The prize-winning entry will appear in the July issue.

$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the June winner will be announced in July and his article published in August. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at space rates.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible.

Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries. Also, novel means of presenting useful data are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.


Temperature correction factor, F
K, Thermal conductivity, Btu./(hr.ft.²(deg.F./ft.))
K (after Timrot & Vargaftik)
Correction factor, F
Mean film temperature, deg.F.
Fig. 2

the existing nomograph to compute h is seen to be $(0.502/0.381)^{4/3}$ or 1.23 or 23 percent too high at 400 deg.

In heat exchangers where the water condensate film is controlling, or nearly so, such an error will throw off design, as in feedwater heaters and hot water converters.

Figs. 1 and 2 have been worked up using the revised conductivity data. Fig. 1 solves the appropriate Nusselt equation for horizontal or vertical tubes, while Fig. 2 provides a temperature correction factor F based on the data of Timrot and Vargaftik. The Nusselt equations represented in the plot of Fig. 1 are[5]

$$h = 0.725 \left(\frac{k_f^3 \rho_f^2 g \lambda}{N D_o \mu_f \Delta t} \right)^{\frac{1}{4}} \text{ for horizontal tubes}$$

$$h = 1.13 \left(\frac{k_f^3 \rho_f^2 g \lambda}{L \mu_f \Delta t} \right)^{\frac{1}{4}} \text{ for vertical tubes}$$

both in dimensionally consistent units. Transforming:

$$h = \frac{1,221\, f(t)}{(N D' \Delta t)^{\frac{1}{4}}} \text{ for horizontal tubes}$$

$$h = \frac{1,020\, f(t)}{(L \Delta t)^{\frac{1}{4}}} \text{ for vertical tubes}$$

where

$$f(t) = (k_f^3 S_f^2 \lambda / Z_f)^{\frac{1}{4}}$$

and where the terms k_f, S_f and Z_f are evaluated at the mean condensate film temperature. Values for liquid water viscosities above 320 deg. F. were determined by extrapolation from an Othmer plot, and latent heat values were taken from the Keenan & Keyes Steam Tables.

Fig. 1 may be extrapolated at will, always providing that the condensate film is in streamline flow.

Example—Steam at 0 psig. is condensing outside a horizontal tube bank consisting of 1,600 tubes of 0.75 in. O.D. on a 1-in. triangular pitch. The temperature difference across the condensate film is assumed to be 24 deg. F. Find h.

NOMENCLATURE

h Condensate film coefficient, Btu./(hr. sq. ft. deg. F.).
D' Outside diameter of tube, in.
F Temperature correction factor, ordinate of Fig. 2.
k_f Thermal conductivity, Btu./(hr. sq. ft. deg. F./ft.).
L Height of vertical condensing section, ft.
N Number of horizontal tubes in a vertical row. For triangular pitch $N = 0.40\ (T)^{\frac{1}{2}}$. For in-line layouts $N = 0.82\ (\alpha)^{\frac{1}{2}}$.
S_f Specific gravity.
T Total number of tubes in a bundle.
X Factor $= ND'\Delta t$ for horizontal tube banks; abscissa of Fig. 1.
X' Factor $= L\ \Delta\ t$ for vertical tube banks; abscissa of Fig. 1.
Y Ordinate of Fig. 1.
Z_f Viscosity, centipoises.
Δt Temperature difference, deg. F.
λ Latent heat of water, Btu. per pound.

Solution—From the table of nomenclature it is seen that $N = 0.40\ (T)^{\frac{1}{2}}$ and $ND'\ \Delta\ t = X$. Hence $N = 0.40\ (1,600)^{\frac{1}{2}} = 16.0$ and $X = 16.0 \times 0.75 \times 24 = 288$. From Fig. 1, when $X = 288$, $Y = 1,090$. If the mean temperature is $212 - 0.5 \times 24 = 200$ deg. F., then Fig. 2 shows that the correction factor is $F = 1.000$. Hence, $h = YF = 1,090 \times 1.000 = 1,090$ Btu./(sq. ft. hr. deg. F.). If the tubes had been vertical, the same procedure would have been followed except that L would have been substituted for ND' in calculating X.

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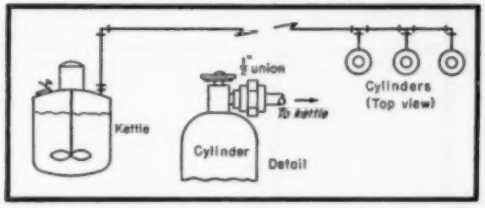

Simple Way to Fight Kettle Fires With Inert Gas

ALLEN J. FRITSCHE, *Chemical Engineer, Ridgway, Pa.*

To combat flash fires in our varnish kettles we constructed some very efficient, simple and cheap fire-fighting equipment from some 50-lb. CO_2 cylinders, ½-in. pipe and a few fittings.

The cylinders have regular ½-in. pipe threads so that only a ½-in. union is needed to connect ½-in. pipe to each cylinder. A bank of three cylinders is manifolded together and a line run to a fitting on the kettle. Whenever a flash fire occurs we simply open the valve on one cylinder and allow the CO_2 to flood the kettle. When the first cylinder becomes empty the valve on another is opened so as to keep a continuous inert blanket of CO_2 over the varnish until its temperature drops below the flash point.

Punch Saves Time in Assembly At Remote Points

ROBERT L. MILLER, *Northern Ohio Engineering Co., Barberton, Ohio.*

It is often necessary to attach instruments, motors, ladders and a host of other items to steelwork located in the field, on the roof, in the yards or at other remote places. Moving the cutting torch may be a long job—and may be undesirable from a safety standpoint. To use an electric hand drill means 100 or more feet of drop cord—and possibly an overheated circuit. Besides, especially with large holes in angles iron the use of a hand drill is neither fast nor pleasant.

We solved the problem on a roof job most effectively by taking a small compound punch off the workbench and using it directly on the work to be punched. Our punch was a Whitney, priced at about $50, and quite effective up to ½-in. holes in ⅜-in. angles. (*Continued*)

Assuring Safety of Receptacles

In its February News-Letter the Chemical Section of the National Safety Council discusses the problem of electrical safety on three-wire grounded electrical receptacles. A recent safety survey of some new operating buildings in a large industrial plant revealed that in many such receptacles there were no mechanical grounds for the third conductor. This conductor is provided to ground the non-current-carrying metal parts of portable electrical equipment. The hazard of using ungrounded electrical equipment is particularly severe in the chemical industry where wet floors are often encountered.

Further investigation showed that in many cases the shunt strap which is supposed to ground the third pole had become disconnected at a soldered joint. Also, in many cases, the polarity of the terminals had become reversed. For these reasons detailed checks are being made to assure that installation is in accord with Underwriters' Laboratories specifications and all grounds are intact. Tests are made simply, on 115-volt, three-wire, single-phase receptacles, with a unit consisting of white, green and red bulls-eye switchboard lamps mounted on the cover of an ordinary shallow outlet box and connected by three-wire conductor to a three-wire cap. The unit shows by means of a bright light, dim light, or no light, or a combination of these, such conditions as correct wiring, reversed polarity, open ground, open neutral, open hot wire, hot and ground reversed, hot on neutral terminal, or hot terminal unwired.

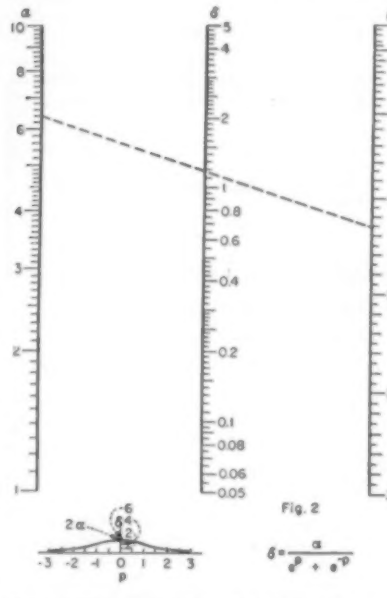

Fig. 2

Values of the Function $e^p + e^{-p}$ for Use With "Bumped" Data

p	0	1	2	3	4	5	6	7	8	9	Diff
0.0	2.000	2.000	2.000	2.001	2.002	2.003	2.004	2.005	2.006	2.008	0-2
0.1	2.010	2.012	2.015	2.017	2.019	2.023	2.026	2.029	2.032	2.036	2-4
0.2	2.040	2.045	2.049	2.054	2.058	2.063	2.068	2.073	2.079	2.084	4-7
0.3	2.091	2.096	2.103	2.110	2.117	2.124	2.131	2.139	2.146	2.154	5-8
0.4	2.162	2.171	2.179	2.188	2.197	2.206	2.215	2.225	2.235	2.245	8-11
0.5	2.256	2.265	2.277	2.288	2.299	2.310	2.322	2.334	2.346	2.358	9-13
0.6	2.371	2.384	2.397	2.411	2.424	2.438	2.452	2.466	2.481	2.496	13-15
0.7	2.511	2.526	2.541	2.557	2.573	2.589	2.606	2.623	2.640	2.657	15-18
0.8	2.675	2.694	2.711	2.729	2.748	2.767	2.786	2.806	2.826	2.846	17-21
0.9	2.867	2.887	2.908	2.929	2.951	2.972	2.995	3.017	3.040	3.063	20-23
1.0	3.086	3.110	3.134	3.158	3.183	3.208	3.232	3.258	3.284	3.311	24-27
1.1	3.337	3.364	3.391	3.419	3.447	3.475	3.503	3.532	3.561	3.591	27-30
1.2	3.621	3.652	3.682	3.713	3.745	3.777	3.809	3.842	3.875	3.908	30-34
1.3	3.942	3.976	4.011	4.045	4.081	4.116	4.153	4.189	4.227	4.264	34-38
1.4	4.302	4.340	4.379	4.418	4.458	4.498	4.538	4.579	4.621	4.662	38-42
1.5	4.705	4.748	4.791	4.835	4.879	4.924	4.969	5.015	5.061	5.108	43-47
1.6	5.155	5.203	5.251	5.300	5.349	5.399	5.449	5.500	5.552	5.605	48-53
1.7	5.657	5.710	5.764	5.818	5.873	5.929	5.984	6.041	6.099	6.157	53-58
1.8	6.215	6.274	6.334	6.394	6.456	6.517	6.580	6.642	6.706	6.771	59-65
1.9	6.836	6.901	6.968	7.035	7.103	7.171	7.239	7.310	7.381	7.453	65-72
2.0	7.524	7.597	7.671	7.745	7.821	7.897	7.973	8.051	8.130	8.209	73-79
2.1	8.288	8.369	8.451	8.534	8.617	8.701	8.706	8.872	8.959	9.047	81-88
2.2	9.136	9.226	9.316	9.408	9.499	9.593	9.687	9.782	9.879	9.976	90-97
2.3	10.07	10.17	10.28	10.38	10.48	10.58	10.68	10.79	10.90	11.00	10-11
2.4	11.11	11.22	11.34	11.45	11.56	11.67	11.79	11.90	12.02	12.14	11-12
2.5	12.26	12.39	12.51	12.63	12.76	12.89	13.01	13.14	13.27	13.41	12-14
2.6	13.53	13.67	13.81	13.94	14.08	14.22	14.37	14.51	14.65	14.80	13-15
2.7	14.95	15.10	15.25	15.40	15.55	15.71	15.86	16.02	16.18	16.34	15-17
2.8	16.51	16.67	16.74	17.01	17.18	17.35	17.52	17.70	17.87	18.05	16-18
2.9	18.23	18.41	18.59	18.78	18.97	19.16	19.35	19.54	19.74	19.94	18-20
3.0	20.14										

Nomograph and Table For Use With "Bumped" Data

D. S. Davis, *Virginia Polytechnic Institute, Blacksburg, Virginia.*

As the author has pointed out previously,[1] in the correlation of engineering test data, the dependent variable y can often be plotted linearly with respect to x, the independent variable, except for a region where a definite "bump" in the curve requires the equation to be

$$y = a + bx + \delta$$

Fig. 1 shows such a plot. In the question, $\delta = \frac{\alpha}{e^p + e^{-p}}$ and accounts for the bump. Here p = a function of x, usually $n(X - x)$; X = the value of x that corresponds to the maximum deviation of y from the straight line $y = a + bx$; $\alpha = \delta_{max}/2$; and n = a constant.

The accompanying table gives values of $e^p + e^{-p}$ to four significant figures for values of p from 0 to 3 in steps of 0.01. However, it does not offer the convenience possible with the nomograph, Fig. 2, constructed by well-known methods.[2] The use of the nomograph is illustrated as follows: Find the value of δ when $\alpha = 6.4$ and $p = 1.66$. Connect 6.4 on the α scale with 1.66 on the p scale and read the desired value as 1.17 on the δ scale.

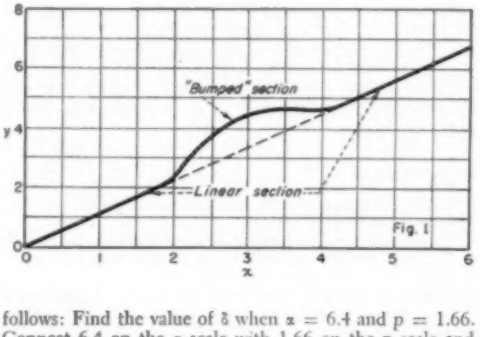

Fig. 1

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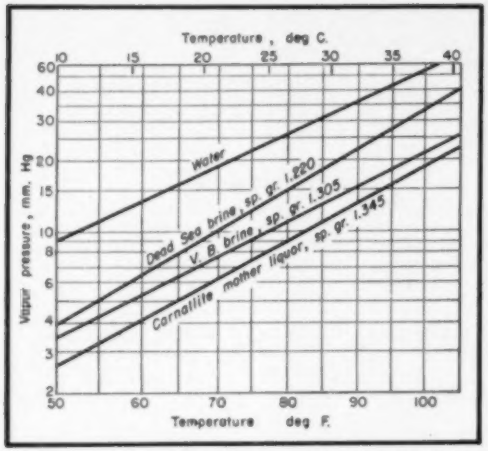

Fig. 2—Vapor pressure of water compared with several brines.

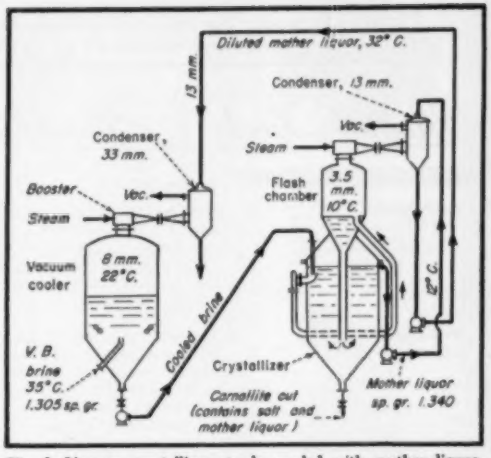

Fig. 3—Vacuum crystallizer can be cooled with mother liquor.

Salt Solutions for Cooling

Brines have a lower vapor pressure than water and so are effective at higher temperature in condenser cooling.

DAVID WITTENBERG

An idea on which little if any information appears in the literature is the use of liquids other than water as cooling media for the barometric condensers used in vacuum refrigeration and crystallization. Sometimes waste brines are available which can be used for cooling, which is particularly helpful when cooling water is scarce or at too high a temperature. In a vacuum refrigeration installation (Fig. 1), the liquid to be cooled is caused to boil at a low pressure under the vacuum produced by a barometric condenser and vacuum producer of some sort, such as a jet. Generally it is necessary to insert a booster between the vacuum chamber and the condenser to compress the vapors to a pressure high enough for condensation with the available cooling water. Brines, however, have a lower vapor pressure than water at the same temperature, as Fig. 2 shows. Hence it may be possible to eliminate the booster, or at least to secure the desired results with a smaller booster.

DAVID WITTENBERG, *Haifa, Israel, is a mechanical engineer. The ideas he expresses in this article were developed in connection with consulting work for Palestine Potash Ltd.*

In Fig. 2 it is clear that the brine from the Dead Sea at 20 deg. C. has the same vapor pressure as water at 10 deg. Neglecting dilution, the same condenser pressure can be maintained with the higher temperature brine. Although the surface temperature reaches over 100 deg. F. in summer, the year-round temperature of Dead Sea brine at a depth of 50 ft. is 20 deg. C. This means an inexhaustible supply of a cooling medium equivalent to water at 50 deg. F. In studying the recovery of potash from the Dead Sea brine it has been found that the production of 15 deg. C. water for processing can easily be accomplished with vacuum refrigeration, using a single-stage unit without a booster. Vacuum refrigeration is preferable to mechanical since to a large extent it avoids the difficulties with corrosion and scaling by the brine that would be encountered with surface condensers.

In the potash operations there are other brines available which also can be used for cooling. The carnallite mother liquor is particularly effective for the purpose, since, as Fig. 2 shows, at 80 deg. F. it has the same vapor pressure as water at 50 and Dead Sea brine at 68 deg. F. The flowsheet in Fig. 3 shows one way in which advantage can be taken of this fact. One of the intermediate brines, known as V. B. brine, can be evaporated in two stages to produce the concentration and cooling needed to crystallize out carnallite. The first stage is shown as a vacuum cooler and the second as a vacuum crystallizer. The mother liquor from the second stage is used to cool the condenser for that stage after which, somewhat diluted and warmed, it can still be used to condense the first stage vapors.

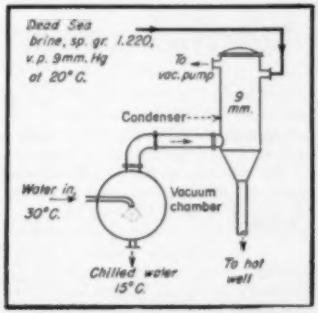
Dead Sea brine, sp. gr. 1.220, v.p. 9 mm. Hg at 20° C.
To vac. pump
9 mm.
Condenser
Water in 30° C.
Vacuum chamber
Chilled water 15° C.
To hot well

Fig. 1.—In vacuum refrigeration Dead Sea brine at 20 deg. C. is equivalent to cooling water at 10 deg. C.

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Pollution Control	Authored by specialists for non-specialists, 12 articles in three parcels: a general introduction; water pollution; air pollution. Why pollution control, what the problems are, how to deal with them. Reprinted from *Chemical Engineering*, May 1951. 48 pages.	Reprint No. 177. Editorial Dept., *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y. $1.
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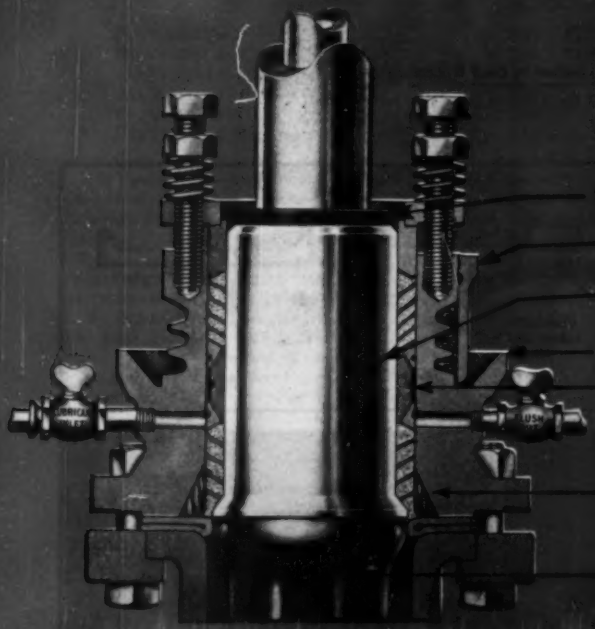
(Continued on p. 272)

THE PFAUDLER HIGH-DUTY STUFFING BOX



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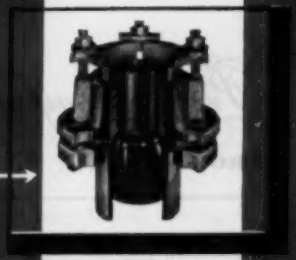

To meet special low-pressure chemical conditions, a variety of packing materials, sealer rings and lubricants are available for Pfaudler low-duty stuffing box.

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The self-centering "no-play" bearing and combination lantern ring in the Pfaudler high-duty stuffing box keep the agitator shaft running true. This eliminates weaving which would destroy the flexibility of the packing.

Replaceable sleeves of Hastelloy or other resistant materials are affixed to the agitator shaft. These prolong the life of the agitator by protecting against corrosion at the point where the agitator enters the stuffing box. The steel agitator stem is accurately machined to give shrink fit and to correct warpage after the glass coating has been applied. Both the agitator end and the conical ring in the bottom of the stuffing box are glass coated. Whenever needed, a water jacket can be easily clamped on.

In addition, special lubricants and counter balance systems can be supplied. And rotary seals are available for reactions where complete elimination of lubricant leakage is required.

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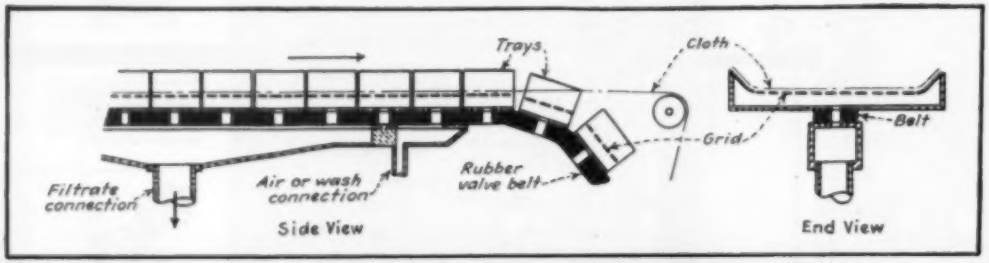

New Filter Designed for Thorough Washing

Recent invention will soon be commercially available to the processing industries.

(144A) A new filter which permits thorough washing of both the filtering medium and its supporting grids has been developed by A. A. Holland, consulting engineer. Although marketing arrangements have not been announced, Mr. Holland reports that several manufacturers of process equipment have shown keen interest in this machine.

Development of this filter is a refutation of the oft-made statement that the day of the lone-wolf inventor is past. Working unassisted at his home at 1705 N. 12th Ave., Pensacola, Fla., Mr. Holland constructed the prototype shown in the above photographs.

Other advantages claimed for the new filter are: (1) All operations are visible; (2) handles coarse materials as well as fine; (3) permits counterflow washing; (4) has gravity discharge; (5) is of simple enough construction to be made, when necessary, of corrosion-resistant alloys or non-metals.

Named the Tray-Band filter, it consists essentially of a series of trays so arranged that they form the links of a chain. Any number of trays can be used.

Each tray is provided with a grid to support the filtering medium. The outside edges of the trays are curved above the grids to form a longitudinal trough for the filter cloth and the slurry being filtered. Rubber cushions seal off the space between the trays.

Flanged pulleys guide the trays on tracks and engage the sprockets. Driving power is applied through two head sprockets, chain, speed reducer, and motor. The filter cloth is driven separately but at a speed synchronized with the speed of the trays. It can be made of any suitable material.

Attached to the under side of the trays is an endless rubber belt which serves as a moving valve seat. The belt is provided with holes which match a corresponding hole in the bottom of each tray. The belt is bolted to the trays so that the trays actually support the belt and carry it along. There is no strain, therefore, on the belt itself.

The purpose of the rubber valve seat is to expose each tray in a desired sequence to various pressure or flow conditions. Provisions can thus be made for vacuum filtration, washing, hot air blowing, etc.

PROCESSING 144
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COMPOSITION MEASUREMENT 161

FOR MORE INFORMATION . . .

Use the reader service card inside back cover. Circle the numbers of items you want to learn more about.

On their return trip, the filter cloth and trays are both subjected to a thorough washing. This feature makes the Tray-Band filter especially suited for filtration of saturated solutions, such as sodium sulphate, which tend to freeze or crystallize in the filter.

By extending the length between the head and tail sprockets, the machine can be lengthened sufficiently to permit the installation of ovens for drying. With the exception of the driving mechanism, the entire machine is made of common structural shapes that can be readily fabricated.

FOR HEAT-SENSITIVE MATERIALS:

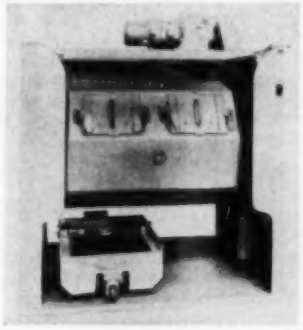
Turba-Film Evaporator

(145A) Principal feature of a recently introduced evaporator, known as the Turba-Film, is that concentration is accomplished continuously in a single pass requiring only a few seconds exposure to heat. This feature makes the new unit of interest for such applications as concentration of fruit juices, vitamins, and various pharmaceuticals.

Manufacture of this line is being undertaken by the Rodney Hunt Machine Co., through its newly organized Process Equipment Div. Although new to this country, similar machines made in Switzerland have been commercially employed abroad.

The evaporator proper consists of a vertical tube whose lower portion is surrounded by a heating jacket. The enlarged upper part of the tube is not heated. A rotor is fitted coaxially over almost the entire length of the tube. Its extended blades reach within about $\frac{1}{32}$ in. of the heated wall, maintaining a thin, turbulent liquid film on the wall. Another function of the rotor blades is to assist in knocking down foam and entrainment. Evaporation is ordinarily carried out under vacuum when heat-sensitive materials are involved.

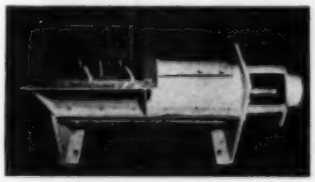
Units are available in stainless steel in various sizes up to 2,500 lb. per hr. of water evaporation. Larger capacities can be provided by arranging two or more units in parallel. The single-pass, vertical arrangement permits an installation requiring comparatively little floor space.



DOORS ARE WATER TIGHT:

Tumbling Machines

(145B) Crown Rheostat & Supply Co. has redesigned and improved its line of tumbling machines. These machines are provided with a variable speed drive and an automatic timer. A newly designed full gasket door plate has been added to provide a water-tight seal and make replacement of the door gasket an easy job. Machines can be supplied with semi-soft rubber linings.

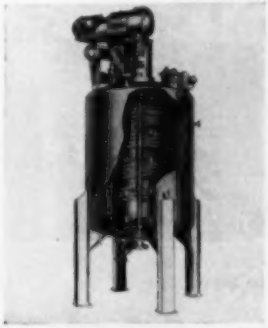


HIGH TORQUE AT LOW SPEED:

Crusher

(145C) Rietz Mfg. Co.'s new Prebreaker, utilizing high torque at relatively low speeds, is designed for a wide variety of crushing and breaking jobs. Of simple construction which makes all moving parts readily accessible for servicing and cleaning, this machine can be used in place of rotary crushers, hammer mills, shredders, and similar equipment.

Prebreakers are made in five sizes, ranging from 10 to 100 rpm., $\frac{1}{2}$ to 100 hp., 6 in. to 18 in. rotor diameter, and 10 in. to 48 in. effective length.



COMPLETE WITH DRIVE:

Hydrogenator

(145D) A new hydrogenator recently introduced by Struthers-Wells Corp. features radial propeller agitators for thorough dispersion of hydrogen and catalyst. This thorough dispersion is necessary to obtain best reaction conditions.

The propeller blade arms are re-

(Continued)

Marshall and Stevens Indexes of Comparative Equipment Costs

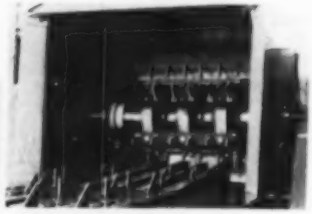
(1926 = 100)

Compiled quarterly for March, June, September, and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, **Chemical Engineering**, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see **Chemical Engineering**, Feb. 1951, p. 158.

Industry	Mar. 1950	Dec. 1950	Mar. 1951
Average of all.....	160.0	177.1	181.2
Process Industries			
Cement mfg.	155.5	169.5	174.0
Chemical	163.5	177.5	182.0
Clay products	150.5	164.5	169.0
Glass mfg.	153.6	167.6	172.1
Paint mfg.	156.8	170.8	175.2
Paper mfg.	157.1	171.1	175.6
Petroleum ind.	159.9	173.9	178.4
Rubber ind.	162.2	176.3	180.8
Process ind. avg....	160.9	174.9	179.4
Related Industries			
Elec. power equip...	165.1	179.1	183.6
Mining, milling	164.2	178.2	182.7
Refrigerating	174.8	195.8	201.0
Steam power	152.2	166.7	171.2

movable to provide easy adjustment of the degree and type of agitation. The agitator shaft is independently supported at two points within the vessels. Included in the new unit are a right angle motoreducer, double mechanical seals, manhole with hinged cover, semi-flexible drive coupling, and removable bottom guide bearings.

Each hydrogenator is individually built to operate under specific conditions of pressure, vacuum, temperature, and degree of agitation. They can be built of stainless, nickel, Monel, Inconel, or mild steel.



TEARS INTO ITS WORK:

Bale Breaker

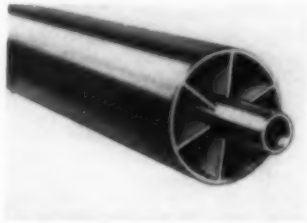
(146A) A new bale breaker made by Taylor, Stiles & Co. will tear open bales of cotton linters, straw, excelsior, tobacco, and leather scrap, even when the bales are so highly compressed that an axe won't cut into them. The bales are brought to a feed conveyor, which pushes them against the revolving head shown in the picture. The bale is torn apart and opened up by the projecting teeth.

The machine illustrated has a throat 36 in. wide and a 24-in. diameter head. Other sizes are made up to a 72-in. throat and 42-in. diameter head.

FRACTIONATING TOWER

(146B) Here is the heaviest piece of petroleum refinery equipment ever shipped by rail, according to the fabricator, Wyatt Metal and Boiler Works. It is a 49-tray depropanizer, 13 ft. 4 in. in diameter by 120 ft. long, weighing over 600,000 lb. In order to insure a safe train trip, the M. K. & T.'s engineering department checked all bridges along the route for clearance and strength.

HEATING & COOLING . . .

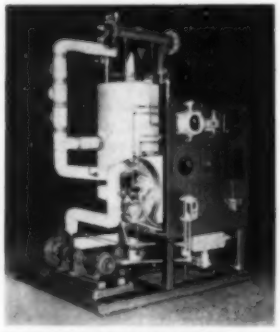


WITH RADIAL FINS:

Heat Exchanger Tubing

(146C) Development of a new heat-transfer surface in the form of concentric tubes with radial connecting fins has been announced by Modine Mfg. Co. Intimate thermal contact between fins and tubes is obtained by fusion bonding. The new tubing can be fabricated of copper, steel, stainless steel, nickel, and other metals, in lengths up to 20 ft., and is suitable for a wide range of temperatures and pressures.

Although the illustration shows six fins, tube geometry can be modified to meet special requirements. Tubing may be equipped with simple tee end fittings to provide easy connections to both passes; it can also be conveniently arranged in series or parallel banks.



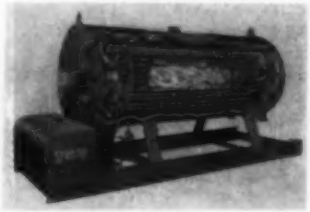
DOWTHERM HEATING UNITS

(146D) Supplied complete with instruments, piping, and other accessories, Struthers Wells' new electrically heated Dowtherm units are available in capacities of 100,000 to 500,000 Btu. per hr. They have a top temperature range of about 750 deg. F. A special heating element is designed to eliminate thermal breakdown and coking troubles.

AVOID OVERHEATING:

Tubular Heaters

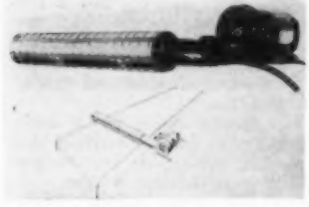
(146E) A new line of tubular electric heaters, announced by the Hynes Div. of the Martin-Quaid Co., is said to permit large input capacity without exceeding critical heat density limitations of the fluid being heated. In electric heating of oils, tars, and other viscous fluids, carbonization and other forms of fluid breakdown result if the liquid is overheated. By using various combinations of tube and element assemblies, Hynes heaters can avoid these difficulties. They are available in moisture- or explosion-proof models.



NEW FIREBOX DESIGN:

Steam Generator

(146F) The latest model Steam-Pak packaged steam generator, manufactured by York-Shipley, Inc., features a new combustion chamber design which is claimed to provide greater heat absorption and more rapid heat transfer than older models. This improvement is the result of a circular flame action, created by blowing swirling excess air into the chamber around the burner. Units are made in ratings of from 15 to 250 hp., operating on gas, oil, or dual fuel.



HOT AIR WHERE YOU WANT IT:

Heat Blower

(146G) An electric heat blower unit, now being made by Master Appliance Mfg. Co., is designed for drying or heating materials on open-width conveyors. The unit blows 400-deg. F. air from a ¼-in. by 36-in. opening at a velocity of 4,800 fpm. Even temperatures and flow are achieved

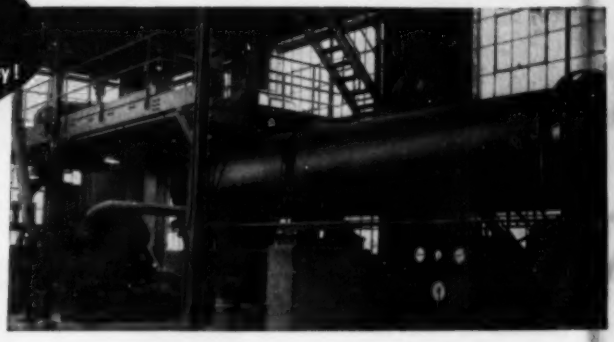
(Continued)

See Louisville for

CREATIVE DRYING ENGINEERING

New Louisville Chemicals Dryer costs less, does 50% more work . . . at 77% less operating expense

KNOW THE RESULTS Before You Buy!



FORMER DRYER

Installed cost	$40,000
Annual production (tons)	6,000
Drying cost per ton	3.72

(space required, 1500 sq. ft.)

LOUISVILLE DRYER

Installed cost	$20,000
Annual production (tons)	9,000
Drying cost per ton	0.83

(space required, 500 sq. ft.)

YEARLY SAVINGS of LOUISVILLE DRYER in OPERATING COSTS ALONE $14,850

Other General American Equipment:
Turbo-Mixers, Evaporators, Thickeners, Dewaterers, Towers, Tanks, Bins, Filters, Kilns, Pressure Vessels

A magician's creation? No! The Louisville Dryer described here was installed by a chemical processor after his production was completely analyzed by a Louisville engineer. By using advanced, complete knowledge of drying processes, this dryer was especially designed to fit into his production line after the dryer's performance was pre-determined in our own unique research laboratories and pilot plant.

Without obligation ask a Louisville engineer to survey your drying methods. He may come up with a better solution that costs you less for faster, more satisfactory production.

PROCESS EQUIPMENT DIVISION GENERAL AMERICAN TRADE MARK

Louisville Drying Machinery Unit

Over 50 years of creative drying engineering

GENERAL AMERICAN TRANSPORTATION CORPORATION

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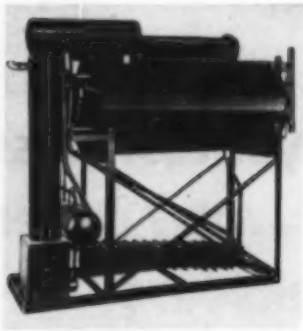
General Offices: 135 South La Salle Street, Chicago 90, Illinois
Offices in all principal cities

throughout the length of the unit, it is claimed.

The heat blower shown here operates on 220 v. and draws 40 amp. Other sizes are being developed for different temperature and flow ratings and for operation on other voltages.



PUTS WASTE HEAT TO WORK:

Refrigeration Unit

(148A) A new Servel refrigeration unit, operating on the absorption principle, can operate on waste heat or waste steam where such are available. When producing chilled water at 45 deg. F., the unit consumes 250 lb. per hr. of steam. It can also operate with gas-firing instead of steam.

The unit delivers 20 tons of refrigeration in the form of chilled water, which is piped to air-conditioning or processing units. It measures 30 in. wide by less than 8 ft. long, occupying only 19 sq. ft. of floor space. Inasmuch as there are no moving parts, no vibration dampening or noise insulation is required.

A SPHERE WITHIN A SPHERE:

Vacuum Bottle

(148B) A new vacuum bottle, consisting of two highly polished copper spheres—one inside the other—has been developed at the Westinghouse Research Laboratories for holding liquid helium at temperatures as low as 8 deg. F. above absolute zero. It is immersed in liquid nitrogen at —300 deg. F. to minimize heat losses. The vacuum bottle is about 1 ft. in diameter and will hold 4 gal. of liquid helium.

Inasmuch as the space between the two spheres is evacuated, reducing heat transfer across the walls, practically all of the heat transmitted into the interior of the bottle is conducted along the neck tube. By making this tube of a narrow diameter, long length, and thin wall, these losses have been cut to a minimum.

Westinghouse thinks that the new vacuum bottle may eventually make it possible to ship liquid helium in thin-walled containers at ordinary atmospheric pressure. This would save both space and material over the use of heavy steel containers and very high pressures required for shipping compressed helium gas.

MADE OF STAINLESS STEEL:

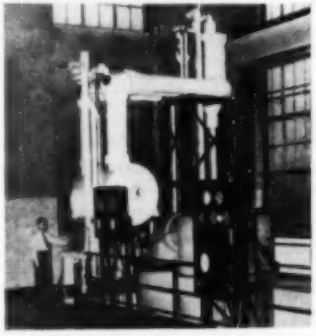
Laboratory Oven

(148C) A new forced draft laboratory oven, available from Schaar & Co., features continuous circulation of air inside the heating chamber. Better uniformity of temperature and improved thermostat response are claimed. A selector switch allows selection of low, medium, or high current input. Construction is of Type 302 stainless steel inside and out.

FOR DIELECTRIC HEATING:

Radiofrequeney Generators

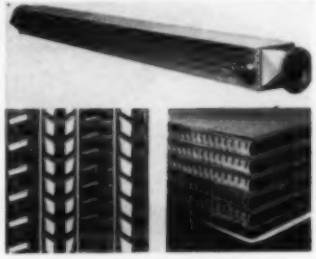
(148D) Westinghouse has brought out two new radiofrequency generators for dielectric heating of non-metallic materials. One unit is rated at 5 kw., the other at 20 kw. They are said to be readily adaptable to batch or continuous production methods, delivering rated power at 100 percent duty cycle.



VACUUM REFRIGERATION UNIT

(148E) This 25-ton Schutte-Koerting unit may be helping you get better shaves. It is used by the Gillette Safety Razor Co. as a part of the dehumidifying equipment which prevents rust and corrosion of packaged razor blades. It consists of a flash evaporator, two 12-in. boosters, a booster condenser, and a two-stage steam jet vacuum pump with barometric intercondenser.

Equipment operating controls are held to a minimum. Enclosures are designed to minimize radiofrequency radiation, and the complete generators are certified to comply with FCC regulations.



HIGH SURFACE-VOLUME RATIO:

Heat Exchanger

(148F) Modine Mfg. Co. has developed a new plate-type heat exchanger which provides a high concentration of surface for low weight and volume. Surface area ranges from 250 to 300 sq. ft. per cu. ft. The new exchanger uses interlocked channel-type fins with special embossings or interrupted surfaces.

Units are designed for easy assembly into blocks to accommodate a wide range of capacity requirements.

MATERIALS OF CONSTRUCTION . . .

FOR CORROSIVE CONDITIONS:

Karbate Heat Exchanger

(148G) The new 240A Karbate shell-and-tube heat exchanger, made by National Carbon Div., contains 70.6 sq. ft. of external heat-transfer surface. Made of Karbate brand impervious graphite, it is suitable for use with a wide variety of corrosive fluids. The shell is made of steel, with stainless steel baffles.

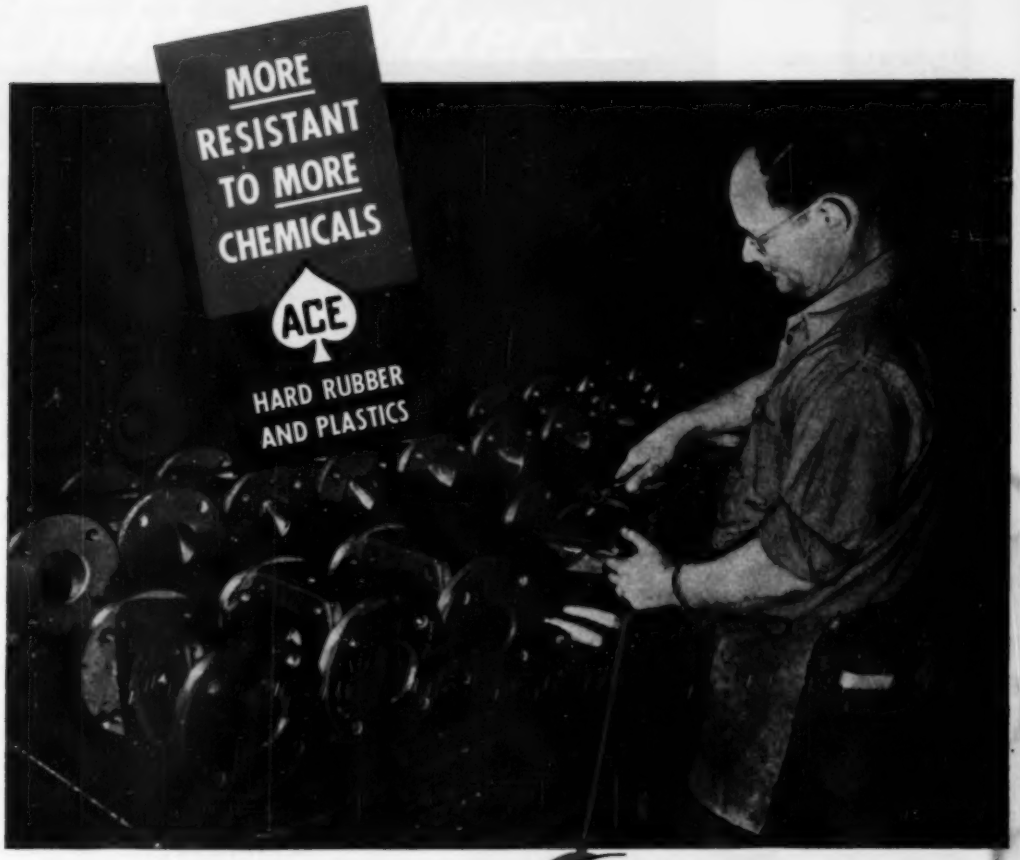
Single-, double-, or four-pass routing of tube side fluid is effected by a simple change of fixed and floating end-cover assemblies. The tube bundle is removable, and tube replacements can be made in the field. The No. 240A is similar to No. 70A but with almost three times as much surface.

FOR CATHODIC PROTECTION:

Ground Anode

(148H) A new graphite ground anode is being made by National Carbon Co. for the cathodic protection of pipelines and other underground or underwater metal structures. The new

(Continued)



HIS SKILL ADDS YEARS TO THE LIFE OF A VALVE...

IF WE HAD to decide the most important factor in the life and economy of rubber-protected corrosion-resistant equipment, we'd say it's the skill with which the hard rubber linings are applied. It takes the sureness, the deftness of experienced hands to produce a perfect, blister-free bond, with the neatest, most dependable seams.

Skill is a proud heritage at the plants of the 100-year-old American Hard Rubber Company. Many of our workmen have been on the job for a decade or more. Many represent second and third generations of skilled rubber workers.

We can supply you with rubber-protected tanks, pumps, piping, valves, fittings, and utensils for complete chemical processing, storage, or circulating systems. Saran and Parian (polyethylene) pipe and fittings also available. Just tell us what you're handling. We'll gladly make recommendations.

100th ANNIVERSARY

AMERICAN HARD RUBBER COMPANY

ACE

11 MERCER ST. · NEW YORK 13, N. Y.

anode, measuring 3 in. × 60 in., provides longer life, since it has more pounds of graphite per unit of exposed surface. It is furnished complete with a 36-in. length of insulated No. 8 weatherproof cable.

MORE FORMS AVAILABLE:

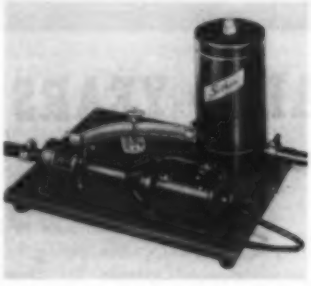
Plastic Shapes

(150A) Kel-F, a high temperature-resistant plastic, is now being produced in tubing with diameters as large as 2 in. by the Plax Corp. This firm is also extruding rods, sheets, and various special shapes to meet growing demand. A polymer of trifluorochloroethylene, Kel-F has good chemical resistance over a wide range of temperatures.

RESISTANT TO ACIDS:

Vinylite Goggles

(150B) A new safety goggle, produced by U. S. Safety Service Co., is molded of acid-resistant Vinylite plastic. The frame remains pliable at all normal temperatures, effecting a tight seal against the face. The one-piece lens, also made of Vinylite, is optically correct; it can be interchanged with other types of lenses. The goggles are designed to permit wearing comfortably over prescription glasses.

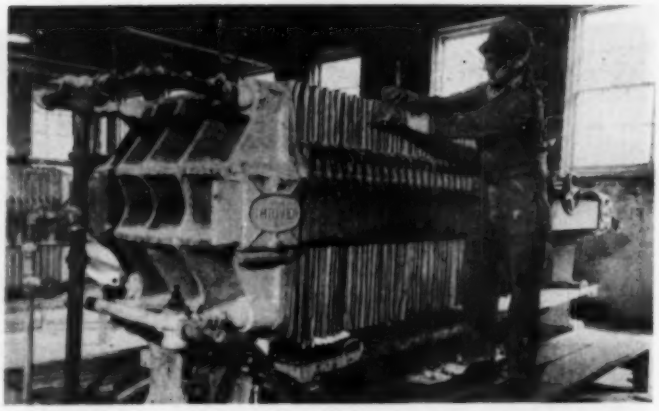


CORROSION RESISTANT:

Filter Unit

(150C) Sethco has brought out a new filter unit, Model HHUE-5, rated at 50 gph. It is equipped with a Haveg filter cylinder and Hastelloy pump and fittings to give good resistance to corrosive liquids, such as electroplating solutions and chlorinated aromatics.

Filter element is a specially processed cotton yarn wound around a stainless steel supporting core. Porous stone or carbon filter tubes are used where cotton would be unsuitable.



FILTRATION OF 10 PERCENT CAUSTIC USES DYNEL CLOTHS

(150D) Dynel filter cloth, used in this plate and frame filter press at a Foote Mineral Co. plant, is filtering 10 percent caustic employed in the manufacture of lithium hydroxide. Made by Filtration Engineers, Inc., from fabric woven by U. S. Rubber, dynel cloths are reported by Foote to have the longest life per dollar value of any material tested. They are highly resistant to most acids, alkalis, and solvents. Cloths are made from spun staple, rather than continuous filament, which makes it easy to seal without requiring excessive rim pressures.

TWO-GUN PETE:

Dual Spray Gun

(150E) Schori Process Div. has just placed on the market a new spray gun for spraying two solutions at the same time. The gun was developed to handle materials that are stable in themselves but which set quickly when mixed with other materials. If such formulations were mixed in a single pot for spraying through an ordinary single gun, the material would set in the pot before it could be sprayed.

It is now possible to use two pots and the spray gun with two nozzles. This arrangement keeps the two solutions apart until they are mixed just as the material is atomized. In a typical example, a resin solution is divided into two portions, one containing catalyst and the other containing accelerator. Pot life of each solution is entirely acceptable, but the coating, combining the two solutions during the spraying operation, gels in only 3 min.

KEEPS THE OLD NAME:

Welding Flux

(150F) A new cast iron welding flux has been announced by All-State Welding Alloys Co. The new flux takes the place of and the name of the former All-State No. 1 Brazaloy flux. A different compound of more finely ground powders, it imparts superior flow characteristics to cast iron welding rods, according to the announcement.

It is sold in drums and in 5-lb., 1-lb., and ¼-lb. containers; and 1 lb. should be provided for each 10 lb. of rod.

PACKAGING & HANDLING . . .

RESISTS GREASE AND MOISTURE:

Drum Coating

(150G) Fiber drums which have been given a protective interior coating of Geon polyvinyl chloride latex, a product of B. F. Goodrich Chemical Co., have been successfully used for shipping lubricating grease. The coating protects the fiber walls from penetration by the grease.

Another application is for shipping a semi-solid textile sizing used in processing rayon. This sizing is poured into the container as a warm, creamy liquid which attains a butter-like consistency upon chilling. When the sizing is unloaded, the bottom of the drum is removed and the entire contents slide out as one lump. This is facilitated by the slick coated surface which eliminates the need for scraping the inside of the drum.

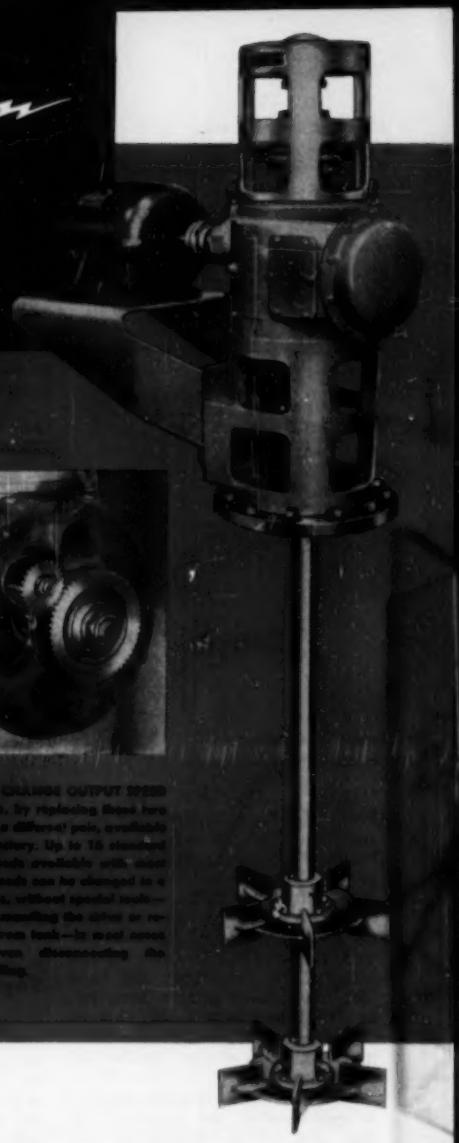
Geon latex may be applied to the interior or the exterior of fiber drums, depending on the type of protection required. An outside coating provides abrasion resistance, protection against

(Continued)

Lightnin® Mixers

MIXCO® Engineered

save plenty on processes that may change later on



ALL INTERCHANGEABLE—

PARTS

IMPELLERS

MOUNTINGS

and now

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YOU CAN CHANGE OUTPUT SPEED at any time, by replacing these two gears with a different pair, available from the factory. Up to 16 standard AGMA speeds available with most models. Speeds can be changed in a few minutes, without special tools—without disconnecting the drive or removing it from tank—in most cases without even disconnecting the motor coupling.

INTERCHANGEABLE SPEEDS—the newest improvement in Lightnin Mixers—can save you many replacement dollars in the years ahead.

With these new Lightnin Series "E" Mixers, you make the changeover from one fluid agitation speed to another quickly, inexpensively—whenever the need arises. The new interchangeable-speed drive gives you most of the advantages of a variable-speed drive—at far lower cost.

Decide *now* to safeguard your investment in fluid agitation equipment, by standardizing on versatile Lightnin Mixers. Remember, every Lightnin Mixer is guaranteed to do the job for which it is recommended.

For friendly help on any process that involves fluid motion within tanks, write us today—or check and mail the coupon for informative bulletins on Lightnin Mixers.

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World's largest-selling line. Electric or air motor, direct or gear drive. Sizes ¼ to 3 HP.

LIGHTNIN SIDE ENTERING MIXERS

For tanks up to 5 million gallons. Gear motor or V-belt drive; enclosed types. Sizes 1 to 25 HP.

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Turbine, propeller and paddle types. For open or closed tanks. Sizes ¼ to 500 HP.

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Please send me the literature checked:

- ☐ B-76 Side Entering Mixers
- ☐ B-78 Top Entering Mixers (Propeller Type)
- ☐ B-89 Top Entering Mixers (Turbine and Paddle Type)
- ☐ DH-50 Laboratory Mixers
- ☐ B-36 Condensed Catalog showing complete line
- ☐ B-75 Portable Mixers (Electric and Air Driven)

Name_____

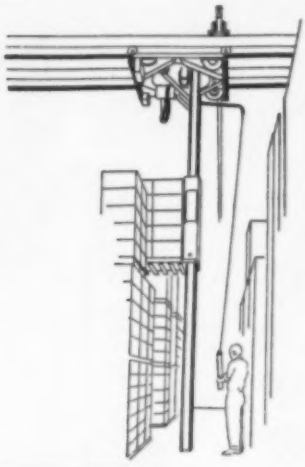
Title_____

Company_____

Address_____

City_____ Zone____ State_____

moisture penetration, and an attractive surface which can be easily washed. Geon-coated drums are now being manufactured by the Virginia Barrel Co.



TIERS FROM OVERHEAD:

Stacker Crane

(152A) Developed by Du Pont's materials handling engineers and available through American Monorail Co., the stacker crane can provide substantial savings in handling and storage space under certain conditions. The new device combines the stacking feature of the fork truck with the overhead mobility of the bridge crane. In effect, the basic fork truck elements have been suspended from the ceiling. This arrangement make possible the maximum accessible storage capacity for a given area.

The operating aisle width required is approximately the length of the load plus 18 in. Savings in aisle width over that required when using fork trucks reduce the size of storage area required or increase the storage capacity of a given area. As to headroom required, the overhead clearance for runway, crane, and stacker unit will range from 21 to 47 in., depending on capacity and span. This distance is normally required anyway for spread of sprinkler heads and diffusion of lighting. Therefore, little, if any, additional building cost is involved. Where additional height is required, however, it can usually be provided more economically, it is claimed, than the floor space and roof construction saved by the new handling method.

The new method of materials handling is of especial interest for use in hazardous areas. Commercially available "spark-proof" fork trucks are not usually considered suitable for operation in solvent vapor-laden areas. Stacker cranes can be made completely explosion-proof by using motors, controllers, cable reels, and wiring meeting Class I group D specifications.

PROVIDES AUTOMATIC ALIGNMENT:

Conveyor Idler

(152B) An improved self-aligning belt conveyor return idler is now being made by Chain Belt Co. The new idler, it is said, greatly reduces the possibility of belt damage because it provides automatic alignment for the return run of the belt without the use of side guide rolls.

It is mounted on a roller bearing turntable, with the entire assembly tilted 45 deg. in the direction of return belt travel. Lateral movement of the belt to one side moves that side of the roll forward and, because of the tilt, downward, thus decreasing belt pressure on that side. At the same time, the opposite side of the roll moves backward and upward, increasing belt pressure on its side. Through this counterbalancing action the belt automatically returns to its central position. The action is said to be equally effective with horizontal, inclined, or declined conveyors and is unaffected by build-up of material on the roll.

NUMBER, PLEASE:

Tape Dispenser

(152C) A new tape dispenser, made by Marsh Stencil Machine Co., has a telephone type dial with which the shipping clerk selects the length of gummed tape needed. A twirl of the dial is all that is needed to start and stop the machine automatically as it dispenses any desired length of tape.

The unit will handle tape 1 in. to 3 in. wide in rolls up to 9 in. in diameter. A 1-qt. water bottle with built-in water heater provides automatic moistening with warm water. The device operates on 110-v., 60 cycle a.c.

WITH HYDRAULIC TRANSMISSION:

Diesel Lift Truck

(152D) A new industrial fork lift truck, powered by a diesel engine and equipped with a hydraulic transmission, was announced recently by Yale & Towne Mfg. Co. Called the Diesel-Lift, this new truck is designed for applications where fire hazards exist, where there is a limited amount of fresh air, and for outdoor areas where continuous heavy-duty operation is required. It is said to be the first unit of its type commercially available in this country.

The new truck uses a 6-cylinder, 70-hp. diesel engine. All power from the engine is transmitted through a double-impeller fluid coupling. The smooth operation thus achieved is said to lengthen clutch life five to eight times.

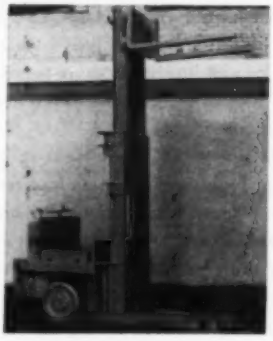
Advantages of the diesel engine over a gasoline engine are the lower volatility and flammability of the fuel and the greatly reduced concentration of carbon monoxide in the exhaust gases.

WORKS IN LESS SPACE:

Sideloading Truck

(152E) Automatic Transportation Co.'s new Sideloader is said to permit complete fork truck operation in aisles as narrow as 6 ft. The device enables a fork truck parked longitudinally in the aisle to stack to either side without having to turn at right angles to the aisle.

Operation consists of two motions. A rotary action turns the forks to either side, and a scissors arrangement then pushes them out as much as 54 in. Lifting procedure is normal. The operation is powered by the truck's hydraulic system.



ELIMINATES COUNTERBALANCING:

Industrial Truck

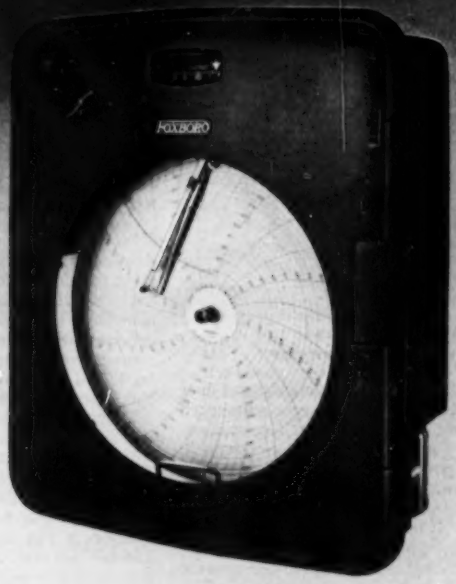
(152F) A new electric industrial truck, announced by Elwell-Parker Electric Co., combines low truck weight with relatively high load capacity. The new truck is a cross between a platform truck and a fork truck. A set of forward wheels eliminates the necessity for counterbalancing, thus increasing the ratio of load capacity to total weight. These wheels,

(Continued)

better measurement and control of

PRESSURE

From vacuum to 80,000 psi . . .



Whether the critical pressure of your process is full vacuum, 80,000 psi, or any range between . . . the complete diversity and engineering quality of Foxboro Instruments provide a means to measure or control it with highest accuracy and reliability. Add to this an unequaled experience in applying instruments to solve processing problems, and you have the reason for Industry's preference for Foxboro Pressure Instrumentation.

INDICATORS · RECORDERS · CONTROLLERS
TRANSMISSION SYSTEMS · CONTROLLED VALVES

FOXBORO
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For over 40 years, specialists in the measurement and control of temperature, pressure, flow, liquid level, humidity . . .

THE FOXBORO COMPANY · FOXBORO, MASSACHUSETTS, U.S.A.

however, are only 6½ in. in diameter, providing for low under-clearance in various type skids.

The new truck is built in several sizes with load capacities ranging from 4,000 to 10,000 lb. As an example of the savings in weight over ordinary fork trucks, Elwell-Parker says that the actual weight of a 6,000-lb. capacity truck of the new type is 4,000 lb. less than that of an ordinary 6,000-lb. capacity fork truck.

WITH ADJUSTABLE HEIGHT:

Portable Conveyor

(154A) The Press-Vator, a new portable elevator-conveyor announced by the E. W. Buschman Co., is essentially a small, cleated conveyor belt, self-powered and adjustable to various loading and unloading heights. It is made in 6- and 8-ft. models.

The model illustrated has a 12-in. wide, 4-ply cotton belt, has a 1-in. high cleat every 24 in., and is powered by a ¼ hp. gearhead motor which drives the belt at 72 fpm. Minimum loading height is 7 in., maximum unloading height, 61½ in; maximum inclination, 45 deg.

KEEPS ITS POWDER DRY:

Packaging Machine

(154B) The Uni-pak, a new packaging machine brought out recently by the Sperry Corp., meters powdered material into individual envelopes and then heat seals them. It uses a continuous strip of envelope material, such as cellophane, foil, paper, or fiberless cotton film. On some materials a production rate of 200 units per min. can be reached.

The machine will make and fill packets of 1¾ in. to 3 in. wide and from 1¼ in. to 9 in. long. It can be set to make two sizes of envelopes at a time—one on each of two production lines. Floor space requirements are approximately 8 sq. ft.

NO MOVING PARTS:

Pneumatic Conveyor

(154C) The FloVeyor system for transporting dry granular solids is a recent development of the Brady Conveyors Corp. Air is admitted into a vessel containing the solids, creating a fluidized mixture of the air and the solids. The material flows through a pipeline to the desired point of delivery just as a fluid would flow under pressure.

Material can be conveyed wherever a pipeline can be run, regardless of the distance or the number of bends in the line, it is claimed. Delivery can be made to any number of receiving bins, process operations, or railroad cars. With no moving parts, maintenance costs are said to be very low.

FLUID FLOW . . .

FOR STREAMLINED CONNECTIONS:

Stainless Fittings

(154D) A new selection of stainless steel fittings designed to meet unusual requirements has been announced by the Special Screw Products Co. These new fittings permit different sizes of tubing, or tube-pipe combinations, up to 1-in. diameter, to be joined by a single fitting. This eliminates the need for bushings and reducing couplings; one fitting does the work of two or three.

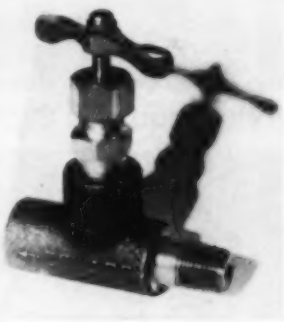
Couplings, unions, elbows, and tees can be ordered to meet a great variety of needs. For example, you can get a tee with a ½-in. tube coupling at one position, a ¼-in. male pipe thread at another position, and a ¼-in. female pipe thread at the third position.

SMALL CAPACITY, LOW PRESSURE:

Vacuum Pump

(154E) The newest addition to Kinney Mfg. Co.'s line of vacuum pumps is a portable model with a free air displacement of 2 cfm. The complete unit, including ½ hp. motor, base, and pump, weighs only 70 lb. Designated as Model CVM 3153, this pump will produce absolute pressures as low as 0.1 micron. It employs the same oil seal pumping system used in other Kinney mechanical vacuum pumps.

Another new pump in this series, the Model CVD 3534, has a free air displacement of 4.9 cfm. and uses a ½ hp. motor. Other pumps cover a capacity range up to 700 cfm.



WITH BUILT-IN NIPPLE:

Gage Valve

(154F) A new gage valve, made by Edward Valves, Inc., eliminates the need for nipples when hooking up pressure gages to piping or equipment, because the male inlet built into the valve serves the same purpose as a nipple. The inlet is an integral part of the forged steel valve body. It has an extra heavy wall thickness for protection against breaking off or rupturing.

Over-all compactness of the valve makes it highly desirable for cramped areas like instrument piping.

FOR CHEMICAL PLANT SERVICE:

Centrifugal Pump

(154G) Nagle Pumps, Inc., has added the Type TW to its line of centrifugal pumps. It features large shafting and bearings, double stuffing box, and a convenient slippage seal adjustment to compensate for wear or unequal expansion. Impeller and housing can be made of various alloys for handling corrosive liquids.

IMPROVED DESIGN:

High Head Pumps

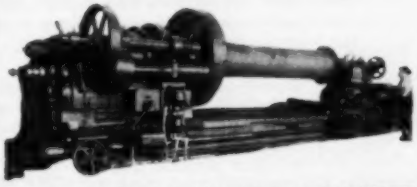
(154H) A completely redesigned line of two-stage pumps, designated as Type DMD, has been announced by Economy Pumps, Inc. These pumps have been improved

(Continued)

POSEY'S STEEL PLATE STORY *in a Nutshell*

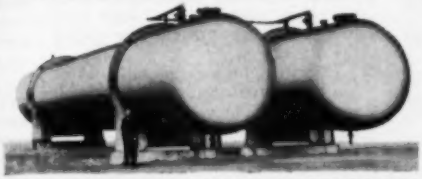
Posey's engineering department is staffed by men with long *practical* experience whose knowledge of shop requirements help end delays.

SKILLED ENGINEERING



Extensive, modernized plant permits Posey Iron to meet both "special" and standard requirements with economy and *speed*.

UP-TO-THE-MINUTE EQUIPMENT



Posey equipment is often delivered with *performance* guaranteed. All standard codes are met with liberal allowance for safety.

GUARANTEED PERFORMANCE

POSEY IRON WORKS, Inc.

STEEL PLATE DIVISION LANCASTER, PA.

TANKS .. STACKS... GENERAL STEEL PLATE CONSTRUCTION

with regard to compactness, efficiency, and mechanical ruggedness, according to the announcement. They are made in sizes from 2-in. to 10-in. discharge and in capacities up to 4,000 gpm. at heads up to 750 ft.

PNEUMATIC OR HYDRAULIC:

Valve Actuators

(156A) Ledeen Mfg. Co.'s new valve actuators are basically pneumatic or hydraulic cylinders, equipped with brackets, valves, controls, and couplings, designed for the operation of any make, size, or type of valve. They can be arranged for on-off or positioning services.

Actuators are available for any pull necessary to operate a valve, up to 40 tons. Pressure of the fluid medium may be as low as 15 psi. or as high as 750 psi. Special cylinders can be made for other pressures. All actuators may be equipped with hand pumps for emergency operation in case of power failure.

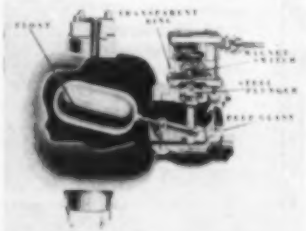
INSTRUMENTATION . . .

REQUIRE NO COMPRESSED AIR:

Temperature Regulators

(156B) A new series of temperature regulators, designated as No. 999, has been announced by Fulton Sylphon Div. They have a press-formed frame of stainless steel which provides minimum heat conduction from the valve to the regulator head. Like other Sylphon regulators, they are self-powered—require no compressed air or other source of power for their operation.

Temperature ranges extend from 40 to 400 deg. F. Valve sizes available are ½ to 4 in.



WITH PICTURE WINDOWS:

Level Control

(156C) Mojonnier Bros. Co. has recently developed a liquid level control for use with ammonia or Freon evaporators which is provided with a sight glass for observation of the liquid level. It is completely sealed for operation under wet and sub-zero conditions. A clear plastic shield fitted over the sight glass prevents frosting at low temperatures.

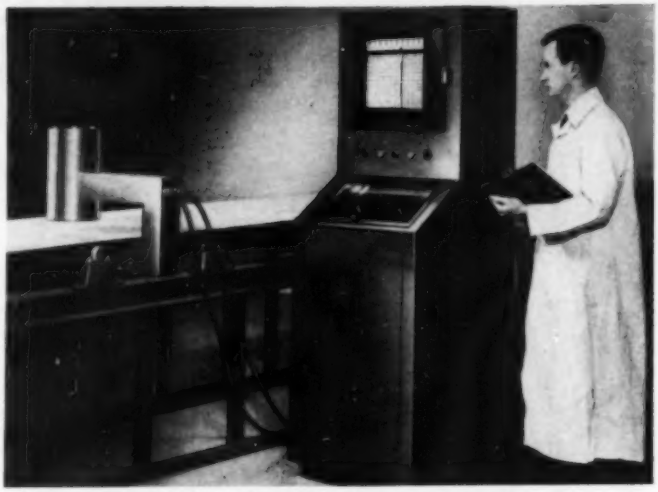
A magnetic switch can be wired to a solenoid control valve. When the stainless steel float is at low level, the plunger is raised, engaging the magnet. When the float is at high level, the plunger is lowered, disengaging the magnet.

Operation of the magnetic switch can be observed through a transparent plastic ring. The switch assembly, being external to the refrigerant, can be serviced without pumping down.

USED WITH DIAPHRAGM VALVES:

Control Relay

(156E) The new Type 227 delayed action relay, made by Black, Sivalls & Bryson, Inc., uses a spring of sufficient power to delay opening of the output port until a certain fixed loading pressure has been reached. Use of this relay in a pneumatic control system delays the action of the diaphragm valve in order to achieve a desired sequence of valve operations in a processing operation. The new relay has cast bronze body and diaphragm casing with stainless steel inner valve assembly and neoprene diaphragm.



BETA RAY GAGE MEASURES THICKNESS OF MOVING MATERIALS

(156D) Made by the Industrial Nucleonics Corp., this instrument will continuously record the weight per unit area or thickness of a wide variety of moving sheet materials, such as metals, rubber, and coated fabrics. It can measure to a few millionths of an inch with touching the material being gaged. Basic components are a source of beta radiation, a radiation detector, and a recording device. The material being measured is run through a gap between the source and detector, preventing a portion of the source radiation from reaching the detector in proportion to the weight per unit area of the material.

FOR RAPID CALCULATION:

Computing Instrument

(156F) A new computing instrument will permit engineers and mathematicians working with problems in statistics and industrial quality control to obtain accurate and rapid results. With this instrument, made by Graphic Calculator Co., you can solve for standard deviations, root-mean-squares, correlation coefficients, geometric and harmonic means, and regression lines. Made of Vinylite rigid sheet, it consists of a 10-inch disk which slides and rotates freely beneath a pair of vertical and horizontal scales on which a series of right triangles is graphically formed.

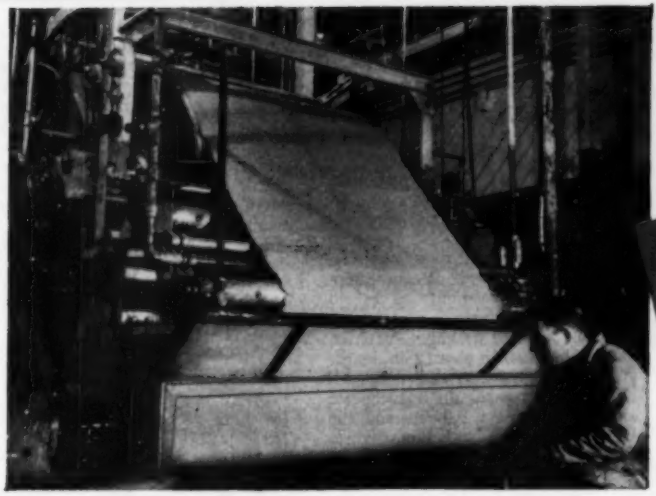
ELECTRICAL . . .

VARIABLE SPEED INDICATOR:

Electric Tachometer

(156G) For motor applications that require continuous and accurate speed indication, U. S. Electrical Motors, Inc., can now provide their ¼ to

(*Continued*)



FOR A BETTER YIELD

BETTER RECOVERY OF *Solubles*

with less dilution on FEinc FILTERS

You squeeze the greatest profits from valuable clear filtrates in three ways with the FEinc rotary vacuum filter. First, the FEinc compression dewatering mechanism removes 2% to 6% more of the valuable filtrate from the cake. Second, the FEinc submergence type washing mechanism, with a compression belt to close up cracks and prevent "channeling" of the wash water, washes out *more* solubles with *less* dilution. Finally, the famous FEinc String Discharge, which lifts the cake neatly from the drum on strings, makes "blow-back" unnecessary, and saves the small amount of filtrate that often is blown back into the cake. Look at these actual cases:

- **Muddy overflow containing fine solids resulted from centrifuge removing extract from ground, cooked liver pulp. Since both cake and filtrate were valuable, processes that contaminated cake with filter medium could not be used. FEinc filter saved cake and gave filtrate so clear that the job could be finished by very small polishing filter.**

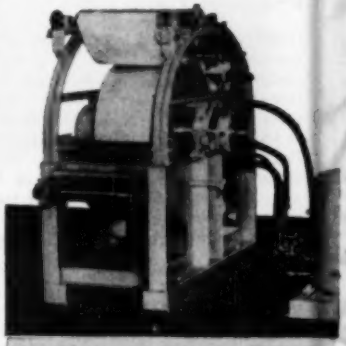
- **Penicillin manufacturer switched to FEinc String Filters when he found centrifugal separators were losing valuable culture broth. Continuous FEinc dewatered so well it even gave time to do a little washing, recovered more broth.**

- **Attempts to separate two oils by filtering out the oil that crystalized at a certain temperature were unsuccessful with ordinary filter. Blow-back returned oil to cake, and scraper smeared cake into cloth. FEinc String Discharge filter now gives firm, clean filter cake, without cloth plugging.**

ASK FOR FEinc technical bulletin No. 103. Just phone or write. Better still, send five gallons of slurry for free tests to:

25

FILTRATION ENGINEERS INC.
155 ORATON STREET • NEWARK 4, NEW JERSEY



GET STARTED RIGHT!

Small FEinc Pilot Plant Filter available on rental-purchase plan. Permits choice of string or scraper discharge. Washing and dewatering mechanisms included, but may be disconnected if desired.

WRITE FOR TECHNICAL BULLETIN

50 hp. Varidrives with electric tachometers suitable for speeds from 2 to 10,000 rpm. The tachometer indicator, which is entirely enclosed to prevent entrance of dust and other foreign particles, can be mounted at distances up to 300 ft. from the drive without affecting accuracy.

The indicator dial normally shows operating speeds as a percent of the maximum speed, although other forms of dial indication are also available upon order.

CONTROLS UP TO SIX CIRCUITS:

Program Timer

(158A) A new time control unit developed by Cincinnati Time Recorder Co. provides for the coordination of clocks, time recorders, and various signaling devices in as many as six circuits. Known as the Master Pro, the new device can handle timing schedules involving periods of 1 min. to 1 week. It is designed for easy set-up and change of schedule, operates on standard 110-v. lighting circuit.

FOR REPETITIVE OPERATIONS:

Recycling Timer

(158B) A new multi-cam recycling timer developed by Industrial Timer Corp. uses a group of cams, mounted on a common shaft driven by a synchronous motor. Although all cams rotate simultaneously, operating snap-action switches, each cam is independently adjustable to provide a specific, over-all timing sequence. Calibrations on each cam face permit individual adjustment for periods ranging from 2 percent to 98 percent of the time cycle.

Nine models are available, with repeating time cycles ranging from one revolution in 40 sec. to one revolution in 72 hr.

FOR CLOSE ATTENTION TO DETAILS:

Flashlight Magnifier

(158C) The improved Flash-O-Lens announced by Abbeon Supply Co. uses a new Bausch & Lomb precision-ground lens system which gives a clearer, flatter field of vision and reduces distortion and aberration. This instrument illuminates the magnified field of vision without throwing direct rays in the user's eyes. It can be supplied for magnifications up to 40 power.

Using standard flashlight batteries, the Flash-O-Lens is about 1 in. longer than a standard two-cell flashlight. Abbeon now makes the housing for the lens system of Bakelite and the case of steel with a hard chrome finish.

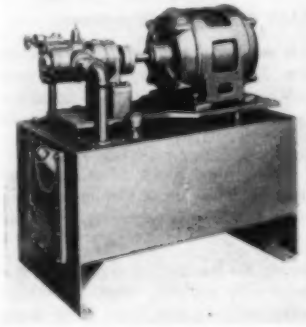
WITH AUTOMATIC RESET:

Synchronous Timer

(158D) General Control Co. has a new synchronous timer, the Type SY Promatic, which can be used for all time periods between ½ sec. and 24 hr. It actuates five s.p.d.t. load contacts independent of the timer-control circuits.

There are two separate solenoids—one operates the clutch and timing mechanism, the other actuates the load contacts. The timer automatically resets for each new cycle. It is available for either 115 or 230 v. a.c. Outside dimensions are 4¼-in. wide, 4¼-in. deep, and 8-in. high, including terminal strips.

MECHANICAL . . .

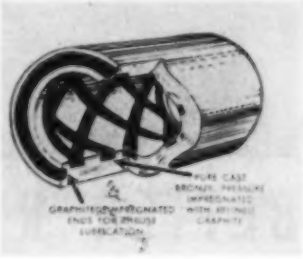


WITH COMPLETELY SEALED TANKS:

Hydraulic Power Units

(158E) Vickers, Inc., has announced a new line of hydraulic power units, available in three series and ten models for electric motors from ½ to 25 hp. Features of the new units include: Completely sealed tanks, with breather air cleaners and separate filler holes having removable mesh screens and chain-attached caps; elevated tank bodies with dished bottoms, drain plugs, and clean-out holes at both ends; and flush type oil level indicators with high and low oil positions marked. Motor mounting plates are separate from tanks for convenience in mounting units.

Single, double, and two-pressure pumps are used for 1,000-psi. service, two-stage pumps for 2,000 psi. Tank capacities range from 20 to 60 gal.



REQUIRE NO LUBRICATION:

Graphited Bearings

(158F) Graphited oil-less bearings and bushings have recently been introduced by Bronze Bearings, Inc. They are graphited with a special composition which is applied under pressure by hydraulic or other means and then baked at high temperature for permanence.

These bearings are said to require no further lubrication during their life. Such bearings are suitable for installation in remote and inaccessible locations, where fluid lubricants would contaminate work in process, where high temperatures would oxidize oil, or where bearings are immersed in liquids.

OPERATES ON COMPRESSED AIR:

Vacuum Cleaner

(158G) Syntron Co. has developed a new industrial vacuum cleaner which operates as a compressed air vacuum jet. It is suitable for use under hazardous conditions where electric cleaners cannot be used.

The new cleaner operates on air pressures of from 70 to 160 psi. Air consumption when operating at 100 psi. is about 4½ cfm. Vacuum obtainable at 100 psi. air supply is 95 in. of water.

The unit comes complete with a 12-ft. length of air hose, ready for operation. Over-all length is 18 in. and net weight, including hose and fittings, is only 3 lb.

(*Continued*)

PRODUCT CONTROL THROUGH *INFRARED ANALYSIS*

Number 1 *of a Series of Data Sheets for Better Process Control from The Perkin-Elmer Corporation, Norwalk, Conn., Manufacturers of Infrared Spectrometers, Flame Photometers and Electro-optical Instruments.*

PROBLEM:
Specific Assay for penicillin G applicable to fermentation broths.

PLANT:
Merck & Co., Inc., Rahway, N. J.

SOLUTION:
Infrared analysis of isotope dilution. Penicillin G tagged with deuterium is added to broth sample. After qualitative isolation and decomposition, infrared analysis yields percent tracer in mixture. See equation, right.

INSTRUMENTATION:
Commercial infrared spectrometer, rock salt optics, standard liquid absorption cell with 0.2 mm spacer.

DISCUSSION:
Principle of method is that ratio of tagged to untagged penicillin remains unchanged throughout process. Method has wide applications to general problem of quantitative analysis of essential components in complex mixtures.

Other Analytical Procedures–Microbiological assay, mass spectroscopy; more tedious or difficult.

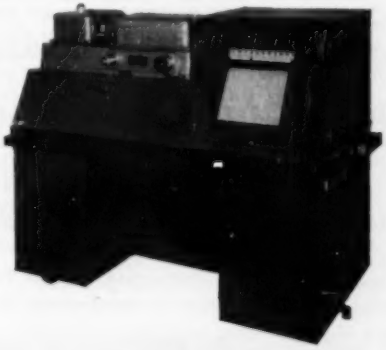
Infrared Spectrometer Analysis – Accuracy independent of amount penicillin present.
Cost: $3.50/assay Time: 2 hrs.

REFERENCES:
Anal. Chem., 21, 285, (1949); ibid., 23, 3, (1951); ibid., 21, 314, (1949); ibid., 23, 487, (1951)

CONCLUSIONS:
Process efficiency enhanced in Rahway, Elkton and Valley Field plants.

$$F = \frac{W_T\,(1-P_T)}{W_a\,P_T} \times 100$$

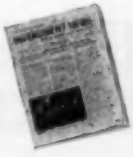
Where F=fraction isomer in sample
W_T=weight in mg. of added isotopic tracer
P_T=fraction of isomer found in the isolated sample
W_a=weight in mg. of sample containing W_T mg. of tracer



MOBILE MODEL 12-C Spectrometer– An Analytical Laboratory on Wheels.

Let us discuss your Product Control Problems with you.

THE PERKIN-ELMER CORPORATION
NORWALK, CONN.



ARE YOU RECEIVING INSTRUMENT NEWS?

This 8-page quarterly brings you the latest developments in electro-optical instrumentation as well as their application to research and process control.

YOU CAN'T RISK FIRES NOW!

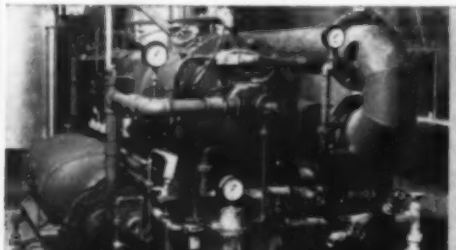
A portable R-C Inert Gas Generator used for purging operations and stand-by protection in large gas-producing plant. Capacity 15,000 cfh.

Today's urgent production demands can tolerate no unwarranted risk of interruption by explosions which might cause even small fires or other plant damage. Against such hazards, R-C Inert Gas Generators provide positive, economical protection.

This protection is essential in plants where inflammable gases, liquids, explosive dusts and other dangerous materials are handled, processed or stored. Available either in stationary or mobile units, R-C Inert Gas Generators greatly reduce the risks from fires caused by explosions. They are compact, simple and sturdy in construction and operate at extremely low cost. Available in capacities from 1,000 to 35,000 cfh.

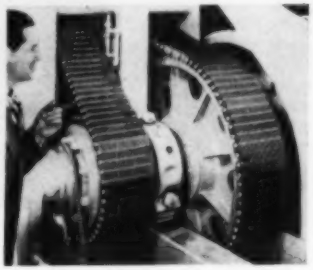
If your operations involve materials or processes which might cause explosion-produced fires, investigate the protection afforded by R-C Inert Gas Generators. Installation costs in many cases can be offset by insurance savings. Ask us for details.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Illinois Avenue, Connersville, Indiana



Installation of three R-C Inert Gas Generators similar to this one helped one large plant save $6,000 per month insurance premiums, as well as substantially reduce danger of production losses caused by explosion or fires. Capacity of each unit, 6,000 cfh.

ROOTS-CONNERSVILLE
BLOWER BUILDERS SINCE 1848
ONE OF THE DRESSER INDUSTRIES



USES NEW DESIGN PRINCIPLES:

Chain Drive

(160A) Morse Chain Co. has announced a chain drive based on entirely new design principles. The new drive is described as combining the ruggedness and dependability of a gear drive with the smoothness and lack of vibration of a belt drive. It will probably find its greatest use with single motors or engines of 100 hp. and up.

A new chain and sprocket engagement principle is said to virtually eliminate the chordal or polygon action common to the usual chain drive. The sprockets also are entirely new in design—they resemble involute gears, having curved involute teeth which engage the links with conjugate action.

The new drive, called the Hy-Vo, makes possible single drive units capable of transmitting as much as 5,000 hp. at linear speeds up to 6,500 fpm. or rotative speeds up to 3,600 rpm. A Hy-Vo drive only 2 in. wide has transmitted as much as 500 hp., it is said.

The two 2-in. pitch, 12-in. wide Hy-Vo drives in the illustration are transmitting 1,500 hp. at 600 rpm. in a portable diesel-electric drilling rig built by Standard Oil of California. The mud pumps for this same drilling operation are driven at 765 hp. and 1,120 rpm. by 1¼-in. pitch, 8-in. wide Hy-Vo drives.

At present Hy-Vo drives are being made in 1-in., 1½-in., and 2-in. pitches in the most demanded chain widths. The range of pitches will be expanded as rapidly as possible, says Morse.

ONLY 4 PERCENT LOSS:

Speed Reducers

(160B) Westinghouse has announced a new line of double-reduction speed reducers available in ratings from 1 to 100 hp. They are designed for applications on drives where the prime mover is coupled or belted to the gear unit.

Eight sizes are available; 12 standard gear ratios range from 6.25 to 58.3

to 1. They use a splash lubrication system and anti-friction bearings; efficiencies are said to average 96 percent.

TEFLON DOES THE TRICK:

Mechanical Seal

(161A) After two years of research and field testing, the Crane Packing Co. has announced a new improved mechanical seal. This new seal is designed for service under severe temperature and corrosive conditions. In place of leather or synthetic rubber, it uses a flexible ring molded of Teflon. Success of this seal is due to Teflon's unique combination of properties—high heat resistance, extremely low friction, and chemical inertness.

The new seal, designated as Type 9, can be used on various rotating shaft applications, such as centrifugal pumps, turbines, positive displacement pumps, and agitators. It is good for temperatures up to 500 deg. F.

COMPOSITION MEASUREMENT . . .

COMPENSATES FOR TEMPERATURE:

Conductivity Recorder

(161B) George Kent Ltd., a British firm, has developed a circuit for measuring conductivity of liquids which incorporates a resistance thermometer immersed in the liquid. This arrangement is said to give full automatic temperature compensation without recourse to a reference cell. It is

(Continued)

RADIATION DETECTOR

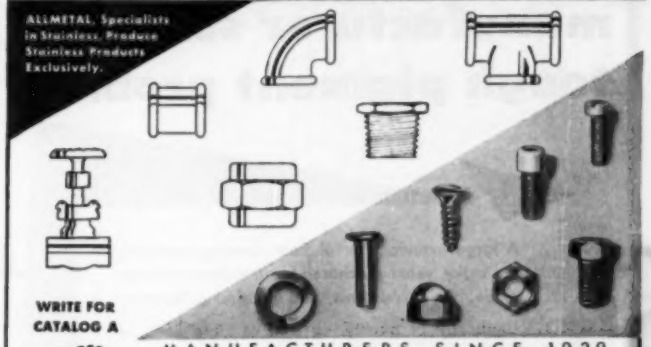
(161C) Ten years of research went into the new pocket-size atomic radiation detector shown in this official Navy photo released by the Department of Defense. Powered by two flashlight cells, it weighs only 2 lb., will probably replace a Geiger survey instrument weighing 24 lb. It is housed in a waterproof, shockproof plastic case. A similar instrument is being developed by the AEC for non-military applications.

FOR YOUR STAINLESS STEEL FITTINGS AND FASTENERS

IT'S ALLMETAL FOR QUALITY AND DELIVERY

Allmetal's fasteners and fittings are stocked in types 304 and 316. Specials to order. All made right by Allmetal.

ALLMETAL, Specialists in Stainless, Produce Stainless Products Exclusively.



WRITE FOR CATALOG A

STAINLESS STEEL FASTENERS

MANUFACTURERS SINCE 1929

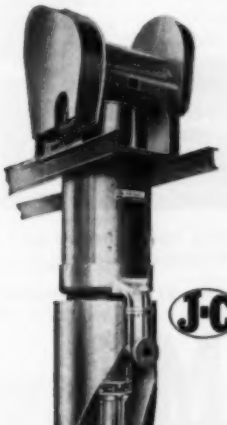
ALLMETAL

SCREW PRODUCTS COMPANY, INC.

33 GREENE STREET NEW YORK 13, N. Y.

HAVING PRESSING PROBLEMS?

LET US HELP YOU AS WE HAVE HELPED THE FOLLOWING INDUSTRIES:



PAPER PULP: Ultra High Density bleaching-de-inking-concentrated black liquor recovery.

CANNERIES: Juice extractions from pulp.

VISCOSE: Optimum press ratios in continuously pressing alkali from cellulose.

CORN STARCH PLANTS: Dewatering germ and fibre.

POTATO STARCH PLANTS: Dewatering pomace.

RECLAIM RUBBER: Drier product (15 to 20% moisture). Low cellulose content.

GLUE PLANTS: Maximum grease recovery and drier pulp.

J-C

J-C ZENITH PULP PRESSES CONTINUOUS AND AUTOMATIC

Are stepping up profits through improved pressing efficiency. For applications to individual problems, for engineering or performance data, write Jackson & Church Company, Department D, at Saginaw, Michigan.

A PRODUCT OF

JACKSON & CHURCH COMPANY, SAGINAW, MICHIGAN

"Work well done since '81"

FOR MEN CONCERNED WITH COLOR

How floor covering manufacturer solves tough pigment problem

A large manufacturer of floor covering materials for many years purchased an imported red iron oxide. This oxide was used in coloring linoleum.

Uniformity of quality, as well as close limits of tolerance on color, tint and strength were part of the specification.

Trouble arrived when the imported oxide became contaminated with foreign matter which made it necessary to screen each shipment. It also varied considerably in tinting and strength characteristics. This made necessary frequent formula changes.

The floor covering manufacturer came to Williams with the problem. A substitute pigment was developed which met the manufacturer's specifications perfectly . . . and manufacturing control was established to hold the product within necessary tolerance limits.

LET WILLIAMS PUT THE MICROSCOPE ON Your COLOR PROBLEM

Whatever your color problem, bring it to Williams. As shown by this case history — and many similar histories in our files — Williams can often save you time and money on proper color formulation.

For complete technical reports, address Department 3, C. K. Williams & Co., Easton, Pa.

IRON OXIDES • CHROMIUM OXIDES • EXTENDER PIGMENTS

WILLIAMS

COLORS & PIGMENTS

C. K. WILLIAMS & CO.

EASTON, PA. • EAST ST. LOUIS, ILL. • EMERYVILLE, CAL.

108 shades and types of iron oxide pigments

considered especially suitable for measuring the conductivity of boiler feedwater, where it is not practicable to use the reference-cell method of temperature compensation.

A number of conductivity cells, each working in a different solution and each compensated for its particular temperature coefficient, may be connected to a single multipoint, multirange recorder.

WITH DUAL POWER SUPPLY:

Moisture Meter

(162A) A meter for measuring the moisture content of various solids has recently been introduced by Weston Electrical Instrument Corp. Known as the Moisturonic, the instrument is available with a special calibration for measuring the moisture content of lumber. The manufacturer is developing new electrodes and new calibrations for other specific materials.

Operating on the resistance principle, the Moisturonic gives instant readings directly on a wide, clear scale. The scales calibrated for use with lumber go from 7 to 30 percent for the lower range and from 30 to 150 percent for the upper range. An all-purpose linear scale can be used to establish special calibrative data and to test any other material into which electrodes can be inserted. The linear scale has uniform graduations from 0 to 100 in the low range and from 100 to 200 in the high range. Lower range is in black; upper, in red.

The Moisturonic is available for either battery operation or for operation on 115 v., 60 cycle a.c.

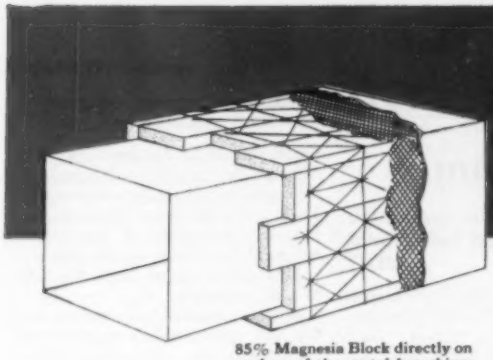
NO CHARTS OR CALCULATIONS REQUIRED:

Liquid Blender

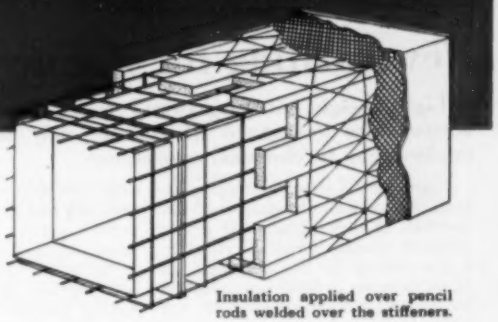
(162B) Bowser, Inc., has developed an automatic proportioning system for blending two or more liquids. The blender can be set for any combination of liquids without requiring charts or calculations. Simple controls on each meter permit setting of ingredient proportions as desired. Total throughput is recorded on a master counter and each ingredient is recorded separately on its own meter.

Failure of any ingredient supply automatically shuts off the entire system. If the supply to any meter slows down for any reason, all meters synchronize automatically to the same rate of delivery. Dials and gages are all visible from the outside of the cabinet which encloses the entire blender.

—*End*



85% Magnesia Block directly on surface of the metal breeching.



Insulation applied over pencil rods welded over the stiffeners.

WE HAVE BEEN ASKED:

"Is it necessary to have an air space between a metal breeching and the 85% Magnesia Block covering it?"

A letter we received a short time ago posed this question—"A metal breeching recently put up in our power plant carries gases at temperatures between 500° F. and 550° F. from our boiler to the economizer. We are going to cover the breeching with 3" 85% Magnesia Block. Would you advise leaving an air space between the insulation and the breeching to prevent heat from scaling or disintegrating the metal?"

Our answer pointed out that recent studies have proved that an air space makes little difference in the temperature of the metal. The design of the breeching is the thing that determines whether or not an air space is recommended. If breechings are free of exterior stiffeners, expansion joints, and other raised parts, the Magnesia block can be applied directly to the metal, wired in place, and finished with insulating cement. However, this condition usually exists only on very short runs or moderate temperature ducts.

If the breeching has expansion joints or stiffeners, V-ribbed metal lath or pencil rods should be welded across the raised parts to provide a flat surface for the insulation.

This method spreads expansion and contraction evenly along the entire length of the breeching and guards against the appearance of unsightly cracks in the plaster finish.

When you have a problem involving insulating materials and insulation methods, call on Armstrong for advice. Over the years, our nation-wide contracting organization has discovered the right answers to just about any insulation problem. Remember, too, that this nation-wide organization offers you a complete insulation service, including good materials and trained construction men to apply them.

SEND US YOUR QUESTIONS: If you have any questions on the use or application of either high- or low-temperature insulation, please do not hesitate to write us. We'll do our best to give you a practical answer. Just address a letter or post card to Armstrong Cork Company, Heat Insulation Dept., 3306 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

New Coating for Magnesium

Light weight of magnesium plus corrosion and high temperature resistance of coating may mean additional applications in chemical processing. (164A)

Magnesium is presently relegated to probably less than one percent of the materials of construction used in the chemical process industries. However a new coating for this metal and its alloys promises to focus new attention on the light material where its use was formerly frowned upon.

Outstanding characteristics of the coating are excellent corrosion resistance, high melting point, good dielectric strength, and hardness.

The finish is called HAE in honor of its discoverer H. A. Evangelides, who made the formulation incidentally while working on a project to determine performance limits of various magnesium coatings for Army Ordnance application.

HAE can be applied to any of the commercial magnesium alloys, wrought or cast, including the magnesium-zinc-zirconium alloy, ZK-60. It is applied electrolytically, much the same as aluminum alloys are anodized. The electrolyte is compatible with magnesium. In other words, it is safe to apply the coating to magnesium castings without danger of any possibly entrapped electrolyte corroding the metal.

Coating bond has been heated to 1,100 deg. F., dropped immediately into cold water without loosening the anodized surface.

CORROSION RESISTANCE

HAE-coated panels show no corrosion up to 90 hr. exposure in salt spray tests and no corrosion up to 4,500 hr. exposure in salt spray when the coated surface is waxed.

Dielectric strength is relatively high. A coating 0.001 in. thick will resist an electrical potential of 550 v. at 60 cycles. From the standpoint of protecting magnesium against galvanic corrosion, this is a valuable property. It is highly probable that insulators will not be required between dissimilar metal joints involving HAE-treated magnesium.

Limited tests have been made to determine the galvanic corrosion resistance of the coating. A pair of 2 in. diameter disks of each of four different metals—aluminum, zinc, steel, and copper—were assembled in contact with both sides of bichromate-treated panels of magnesium alloy. The magnesium panels were 4 x 6-in. Each panel and each disk had a ¼-in. hole in the center. Disks and panels were held together by a nut and a screw passing through a plastic sleeve and with a plastic washer on each side to insulate the screw and nut from the disks and panel. The assembled panels were placed at 15 deg. from the vertical and exposed to the salt spray. At the end of 4 hr. exposure, the HAE-treated panels showed no signs of corrosion, while the bichromate-treated panels were badly corroded.

HIGH TEMPERATURE RESISTANCE

The new coating provides magnesium with a surface which is resistant to temperatures above 2,500 deg. F. If a panel of the coated metal is held vertically and subjected to the flame of two Fisher blast burners, the magnesium will melt locally and form a bulge without cracking.

STRENGTH, ELASTICITY

The strength and modulus of elasticity are not yet known. A 0.002-in. thick specimen of magnesium loses about 8 percent of its tensile strength after 1½ hr. treatment. The loss in tensile strength is approximately proportional to the thickness build-up of the treated specimen, i.e., about 80 percent of the total coating thickness. However, as the thickness of the specimen increases, the percentage loss in tensile strength will diminish. For example, a 0.064-in. thick specimen having a coating 0.0012 in. thick on each side will lose less than 0.5 percent in tensile strength due to the coating.

The coating is relatively inelastic, especially on the compression side of a bend. A sample of HAE-treated magnesium sheet can be bent and dented severely without visible damage to the coating on the tension side and without a complete break-through on the compression side. There is a visible flaking-off of a superficial layer of the finish on the compression side of the bend but not a complete break-through unless the radius of the bend is relatively sharp. The extent to which this flaking-off of the superficial layer reduces the corrosion resistance of the finish has not yet been determined. There are indications, however, that certain modifications of the process will result in a more ductile finish.

HAE appears to be chemically inert to most materials.

It seems reasonable to assume that this new coating will mean additional applications for magnesium. However, these will need to be tempered with additional knowledge of its characteristics, limitations and possibilities.

Cost of applying the finish on a production basis has not yet been determined but it will probably be close to the cost of anodizing aluminum since the processes are quite similar.

The coating is available, at present for military applications only.

Refractory Coating

Claimed to be extremely hard. Expands and contracts uniformly with refractory material. (164B)

Tests have shown that the coating will prevent slagging, spalling, abrasion and disintegration of firebricks caused by combustion chemicals and high temperatures. The material is called Drew Refractory Coating, made by the E. F. Drew Co.

Advantages are a smooth, hard surface which results in greater reflection of heat; greater protection and longer life of firebricks; ease of application. Boilers may be fired immediately after application, it is claimed.

The product is in liquid form, can be brushed on or sprayed.

Rubber for Molded Seals

Performs effectively over extreme temperature range. (164C)

O-rings and other precision molded seals may now be obtained in a newly-developed extreme temperature range synthetic rubber compound. The Parker Appliance Co. has released the compound, calls it Parker 42.

Resistant to non-fuel petroleum products such as lubricating oils and hydraulic fluids, the compound functions effectively in sealing performance anywhere in the temperature range of from −85 to 275 deg. F. The compound is also especially satisfactory for service with ozone, having an ozone resistance of 0.003 percent for 6 hr.

Liquid Defoamer

For paper industry. Good solubility. Easy handling. (165A)

This new product, named De-airex 506, marketed by E. F. Houghton and Co., is a clear amber colored oil which is immediately soluble in either hot or cold water. In addition to its foam controlling ability, the product offers such advantages as ease of handling and mixing; stability of solutions (they can stand for several days); and resistance to damage from freezing.

According to the company, the product provides economical foam control per ton of paper produced. A dilute emulsion handles most severe foam conditions.

Three New Sulfones

Research quantities. Others commercially available (April 163B). (165B)

The new products, produced by the Monsanto Chemical Co., are bis-(p-chlorophenyl) sulfone, bis-(3-amino-4-hydroxyphenyl) sulfone, and bis-(4-chloro-3-nitrophenyl) sulfone. Development of the new sulfones, was predicated upon the desirability of making available a greater diversity of substituent groups based upon the stable sulfone structure.

The sulfones are believed to have a wide range of applications as intermediates in dyestuffs and in organic synthesis, and for biocides as well as for other chemicals. Dichlorodiphenyl sulfone has been reported as an effective synergist in DDT formulations.

Inhibitor

Protects shellac and other nonaqueous liquids from metal contaminants. (165C)

In view of NPA's restrictions on shellac containers, a new inhibitor from Monsanto's Merrimac Div. has made a timely appearance. The material prevents iron pick-up by forming a thin coating of a complex iron phosphate on the inner wall of the container. In effect, Inhibitor 038 prevents the metal from becoming soluble in the shellac.

A 40 percent alcohol solution of an organic phosphate was found to give the best results in low concentrations. Shelf aging tests of 12 mo. demonstrated that Inhibitor 038 could be of service to shellac cutters whose products normally require packaging in heavy terne-coated cans.

The tests indicated that 0.5 to 1 percent of the material in 8-lb. terne-coated containers provided satisfactory protection from iron contamination for a minimum shelf life of one year. A minimum of 1 percent of the new product was necessary to protect most commercial shellacs in SCMT plate.

Stabilized Lead Tetra-Acetate

Can be stored for months at temperatures as high as 130 deg. F. (165D)

A stabilized lead tetra-acetate which can be stored at room temperature has been released by Arapahoe Chemicals Inc. This greatly improved stability should open the door to commercial exploitation of its unique properties as a glycol splitter and specific oxidizing agent according to Arapahoe.

The wide use of the compound in the laboratory for transformations involving compounds of the steroid type makes it of particular interest in the fields of pharmaceutical and biological chemistry.

Trichlorobenzene

Mostly 1,2,4 isomer. Small amounts of other isomers, high boiling materials. (165E)

As is well known, trichlorobenzene is a major ingredient in compounded transformer oils and is an excellent solvent for oils, fats, waxes, certain resins and oil soluble dyes. It is also used as a dye intermediate, a heat transfer medium, a lubricant and as a toxicant in the control of termites.

Not so well known is the fact that the Pennsylvania Salt Manufacturing Co. is offering the solvent in pilot plant amounts and in sample quantities for evaluation.

High Viscosity Detergents

Nonionic. Unique thickening properties: 10 percent solution has viscosity of 1,000 cp. (165F)

A development of interest to both research and production chemists is the announcement of a new line of synthetic nonionic detergents having unique thickening properties even in dilute solutions. One member of this series, Ninol 2012A, is so effective that even a 2 percent solution in distilled water has a viscosity of several hundred centipoises. Other members show the interesting property of becoming thicker when diluted, instead of thinning out as might be expected. For example: an 80 percent solution of Ninol 737 has a viscosity of only 50 cp., while a 10 percent solution is 1,000 cp.

Advantage can be taken of this property to thicken dilute solutions of other synthetic detergents and soaps —most of which are quite thin at low concentrations. One member of the series, Ninol 1281, is now being widely promoted for use in the production of viscous liquid Synsoaps, which are blends of potash soaps and synthetics combining the desirable features of both. Other suggested applications are: thickening and stabilizing agents for resin latex or emulsion paints, in detergent products such as clear or cream shampoos, and in dishwashing liquids and institutional cleaning compounds where higher viscosity is desired.

Bonding Agent

Cements silicone rubber to almost any surface. Bond strengths greater than the strength of the rubber itself. (165G)

A new chemical development makes possible a bond between silicone rubber and metals or ceramics. General Electric's Chemical Dept. developed the light colored liquid, has designated it G-E 81267 primer. By using it, G-E silicone rubber 81223 can be bonded to almost any surface, according to the company. Bonds to glass, ceramics, aluminum, steel, tin, and copper are possible, and shear strength measurements of bonds on steel are approximately 700 lb. psi. A unique feature of the primer is its ability, in

(Continued)

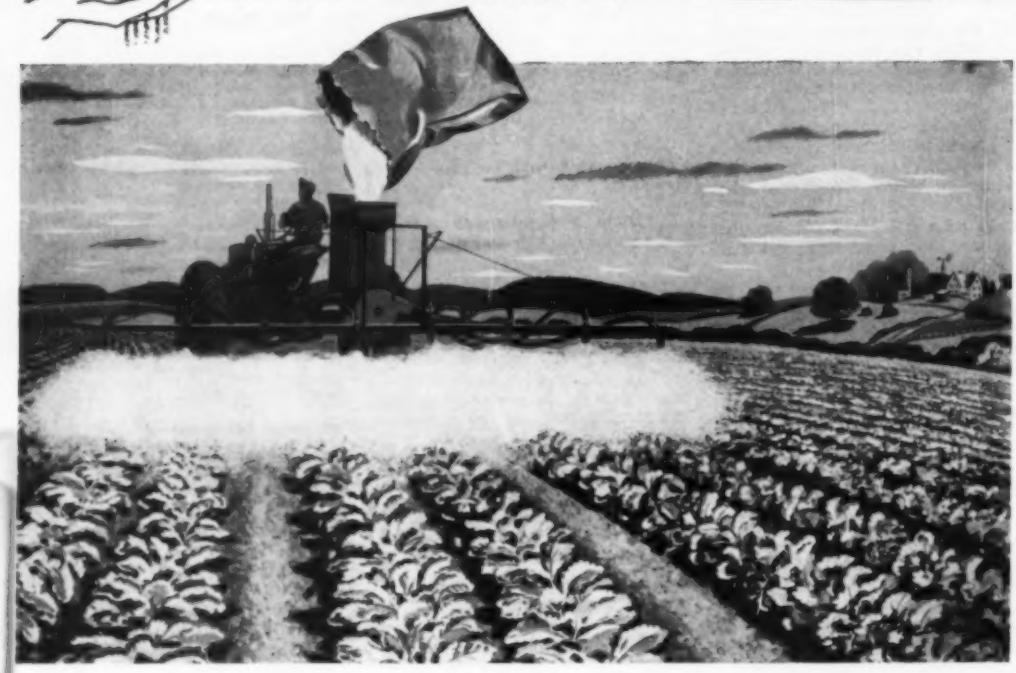
New This Month . . .

	Page & Item
New Coating for Magnesium	164A
Refractory Coating	164B
Rubber for Molded Seals	164C
Liquid Defoamer	165A
Three New Sulfones	165B
Inhibitor	165C
Stabilized Lead Tetra-Acetate	165D
Trichlorobenzene	165E
High Viscosity Detergents	165F
Bonding Agent	165G
Dye Intermediate	167A
Coating	167B
Wool Treating Chemical	167C
Dacron	168A
Liquid Neoprene Spray	168B
Resin for All Pulps	170A
Improved Tall Oil	170B
Expanded Perlite Fines	172A
Alkyl Phosphites	172B
Dyes for Iron Cores	172C
Flameproof Orlon	174A
Ceramic Metal Coating	174B

For More Information . . .

Use the Reader Service card inside the back cover. Circle the number of item which you want to learn more about.

How Celite Mineral Fillers give a product better dispersion . . .



Making a better "killer" of insecticides

To increase the effectiveness of their product... add more "killing power"—many leading producers of insecticides add Celite Mineral Fillers to their dust as a standard ingredient.

This use of these diatomite powders is based primarily on (1) their light weight and great bulk which improve dispersion of the poison, and (2) their high absorption capacity that produces dry dust concentrates from both low melting point solids and liquid poisons, thereby increasing the potency of the final product.

These and other unusual physical characteristics adapt Celite Mineral Fillers to numerous industrial uses.

CHECK LIST OF PRODUCT BENEFITS OBTAINABLE AT LITTLE COST WITH CELITE MINERAL FILLERS

- Added Bulk
- Better Suspension
- Faster Cleaning Actio
- Greater Absorption
- Improved Color
- Better Dielectric Properties
- More Durable Finish
- Increased Viscosity
- Elimination of Caking
- Higher Melting Point
- Better Dry Mixing
- Improved Dispersion

THESE CELITE PROPERTIES BENEFIT MANY TYPES OF PRODUCTS

Because of their inertness and great bulk per unit of weight, Celite Mineral Fillers make ideal bulking agents for powders and pastes. Their tiny multi-shaped particles interlace to stiffen and strengthen admixtures. The microscopically small facets of these particles diffuse light so effectively that they will give any desired degree of flatness to a surface film. And their porous, thin-walled cellular structure can be utilized to impart a delicate, non-scratching abrasive action.

You may find Celite the "extra something" needed to lift your product above competition. Why not discuss its application to your problem with a Celite engineer? For further information and samples, write Johns-Manville, Box 290, New York 16, N. Y. In Canada, 199 Bay St., Toronto, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville CELITE®

MINERAL FILLERS

most cases, to develop a bond strength greater than the strength of the rubber at any stage of the cure.

The new development now makes possible a wide variety of silicone rubber-to-metal molded products which include shock and engine mounts that resist both high and low temperatures. Also improved rubber-glass laminated structures are now possible, and G.E.'s new high-strength silicone rubber in conjunction with G-E primer can be used as an adhesive with unusual new properties.

Dye Intermediate

Also may be useful in Pharmaceuticals. Commercial quantities. (167A)

A new dye intermediate known as "pcp," hitherto available only in research quantities, has been introduced commercially by Winthrop-Stearns Inc.

The product, 1-phenyl-3-carbethoxy-pyrazolone-5, is used in the synthesis of extremely light-stable dyestuffs and colors, some of which are particularly suitable for color photographic processes.

It is being supplied in standard drums of 250 lb. The first laboratory sample of "pcp" was synthesized at the Sterling-Winthrop Research Institute one year ago.

Pharmaceutical laboratories seeking to develop potential uses in the synthesis of new drugs now also have the product under study.

Coating

Resistant to all alkalis, solvents, salts, and most acids. (167B)

Called Alkaloy 550, this product is available as a high solids liquid which is converted at the time of use to a jet black resilient solid. Products of this general type based on furfuryl alcohol have been known since 1940. However, coatings based on these compositions have been unsatisfactory in many cases because they were brittle. The inherent flexibility of Alkaloy 550 is said to be the answer to this problem.

Wool Treating Chemical

Prevents harshness, loss of tensile strength and uneven dyeing. (167C)

This new chemical, Maxitol No. 10, actually becomes part of the wool fiber and is resistant to the action of the

(Continued)

An informative discussion of dry chemical fire extinguishing agents with particular emphasis on factors responsible for quality and dependability. . . . . by

Arthur B. Guise
Chief Engineer
Fire Extinguisher Division
ANSUL CHEMICAL COMPANY

ANSUL DRY CHEMICAL
CONTROLLED QUALITY FOR CONSISTENT DEPENDABILITY

Your extinguishers can fail to operate when you need them most . . . or operate with less than maximum effectiveness and fail to extinguish the fire . . . unless properly maintained and charged with dependable first quality extinguishing agents.

This is equally true of dry chemical fire extinguishers. Ansul *"PLUS-FIFTY"* Dry Chemical is produced under carefully controlled conditions to meet specific requirements. *This means that every container of Ansul Dry Chemical has the same uniform high quality.* Ansul Extinguishers are designed for use with Ansul Dry Chemical only and, if consistent high fire extinguishing effectiveness is to be obtained, Ansul Dry Chemical should be used for recharge purposes.

There are a number of factors influencing dry chemical quality and all must be controlled because variations in a dry chemical can affect its fire extinguishing effectiveness.

PARTICLE SIZE. The sodium bicarbonate in Ansul Dry Chemical must pass tests to insure that the size of the particles falls into a certain range. If a certain percentage of the particles are over a maximum given size, the fire extinguishing effectiveness of the dry chemical is measurably decreased. Ansul's quality control procedures insure that the fire extinguishing effectiveness is always high.

MOISTURE REPELLENCY. The materials and methods used to produce water repellency in the finished dry chemical directly affect its flow and packing characteristics and electrical resistivity. All dry chemicals will absorb moisture when exposed to highly humid atmospheres. Excessive moisture absorption causes caking of dry chemical and resultant failure of the extinguisher to operate. Ansul Extinguishers and shipping containers for dry chemical are weather-proofed to minimize the possibility of moisture absorption . . . and Ansul provides a further safeguard by furnishing a dry chemical which *can absorb four times more moisture than ordinary dry chemicals* without harmful effects to any of its characteristics.

FLOW. Ansul Extinguishers are designed to discharge dry chemical at a definite rate. Quality control during the manufacturing operation insures that Ansul *"PLUS-FIFTY"* Dry Chemical will flow at a sufficiently high rate to insure maximum fire fighting effectiveness.

MODEL 20-B

PACKING. *All* finely divided solids tend to pack. Dry chemical is no exception. Daily tests of Ansul *"PLUS-FIFTY"* Dry Chemical as it is produced insure that every batch will fluidize readily. Proper design of Ansul Extinguishers doubly insures fluidizing of dry chemical and proper, effective, discharge.

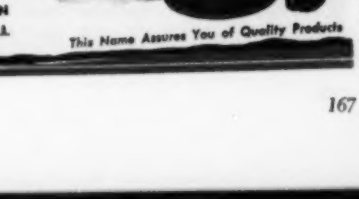
ELECTRICAL RESISTIVITY. Ansul *"PLUS-FIFTY"* Dry Chemical has an electrical resistivity of 1000 megohms. Frequent tests are made to insure that all Ansul Dry Chemical is equally resistive and always safe to use on electrical fires. Again, Ansul Dry Chemical can absorb four times more moisture than ordinary dry chemicals without impairing its electrical resistivity.

SUMMARY. Ansul's Engineering and Research Departments have developed specifications and tests to control particle size, moisture repellency, flow and packing characteristics. Last year 3500 flow tests were conducted on Ansul Dry Chemical to assure uniformly high quality of the manufactured product. You are assured of consistently high quality and maximum dependability with Ansul *"PLUS-FIFTY"* Dry Chemical.

Send for your copy of File No. 675. You will receive additional technical information on dry material describing Ansul's complete line of Dry Chemical Fire Extinguishing Equipment.

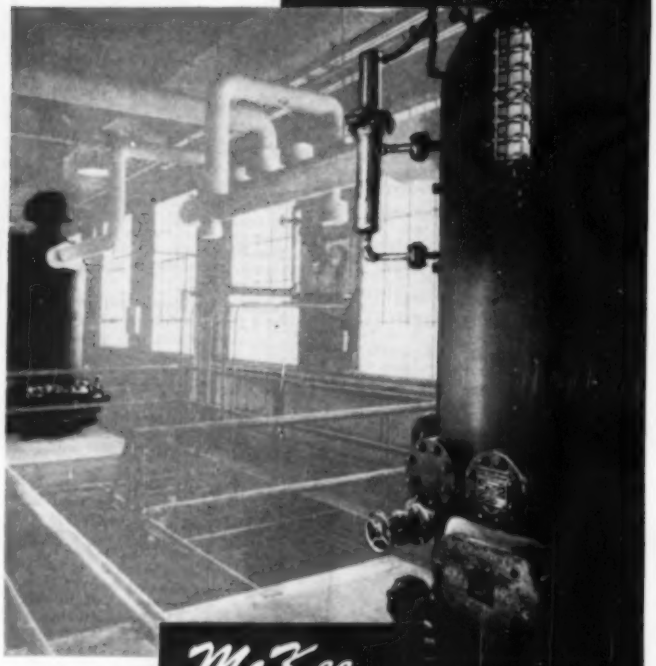
ANSUL
CHEMICAL COMPANY
Fire Extinguisher Division
MARINETTE, WISCONSIN

DISTRIBUTORS IN ALL PRINCIPAL CITIES IN THE U.S.A. CANADA AND OTHER COUNTRIES



This Name Assures You of Quality Products

"PRE-FAB" HOUSES BUILT MUCH FASTER



. . . thanks to

McKee DOWTHERM VAPORIZERS

Two 1,000,000 BTU McKee Dowtherm Vaporizers installed for heating a huge platen press making panels for prefabricated homes.

in Processing Pre-Fabricated Panels

Your problems may be far removed from pre-fabricated homes . . . but if they involve process heating in any way it will pay you to investigate Dowtherm's unique ability to give you High Temperatures at Low Pressures . . . always under complete control and at considerable saving.

Dowtherm Vaporizers are available in Horizontal Models, 12 sizes from 300,000 to 3,500,000 BTU and in Vertical Models, 18 sizes from 30,000 to 2,000,000 BTU.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

Eclipse Fuel Engineering Company
721 So. Main Street, Rockford, Illinois

McKee Eclipse

THE MOST COMPLETE LINE OF GAS-FIRED EQUIPMENT ON THE MARKET

bichromate. Because Maxitol is chemically bound to the wool, it is reported that, in addition to its buffering action on chrome, in chromate dyeing, further protection is provided throughout subsequent processing operations, and even for the life of the fiber.

Wool treated with the new chemical will, as a result of this protective action, show less deterioration and loss of tensile strength, and will gain a softer and loftier hand.

As a dye leveler, Maxitol is highly efficient and keeps dyestuffs well dispersed and facilitates their penetration into heavy fabrics and hard twisted yarns.

Dexter Chemical Co. developed the product.

Dacron

In the first detailed report from Du Pont, suits worn in rain and slacks laundered in a washing machine held their press. (168A)

Distinctive functional properties of Dacron are high wet and dry resilience, dimensional stability under wet and dry conditions, high stretch resistance coupled with high strength, high bleach resistance and high heat resistance.

The most natural outlets for Dacron appear to be in suitings and all types of outerwear.

Among the problems still to be licked are "pilling," the forming of little balls of fiber on the surface of a fabric, and static (under conditions of low humidity) which results from low electrical conductivity because of low moisture content in the filler. Another problem is dyeing, a difficulty shared by all of the new fibers.

Technically, Dacron is a condensation polymer obtained from ethylene glycol and terephthalic acid. It is not chemically related to nylon.

Potential industrial uses of the new fiber are in fire hose, where the combination of strength and light weight make lighter and more flexible hoses possible with correspondingly greater hose footage per truck; and in V-belts, rope, laundry nets, and sail cloths.

Liquid Neoprene Spray

Fast curing at ordinary temperatures. (168B)

The liquid neoprene coating developed by Atlas Mineral Products Co. has now been improved so that it is readily sprayed and is fast-curing at ordinary temperatures.

This product which is available both

(Continued)

Build future business with products from Diethylene Triamine

$H_2NCH_2CH_2NHCH_2CH_2NH_2$

Diethylene Triamine reacts with acidic materials, such as fatty acids, to form soaps that may be dehydrated first to amides, then to glyoxalidines. It is a good solvent for many resins and dyes.

Its present uses include:

- A catalyst activator in emulsion polymerization of synthetic rubber and vulcanization of foam rubber.
- A catalyst for epoxide-type casting resins.
- An anti-livering agent for varnishes that are based on either phenolic resins or alkyd resins.
- Making—corrosion inhibitors

emulsifiers	ion-exchange resins
emulsion breakers	textile-finishing agents
wetting agents	asphalt additives

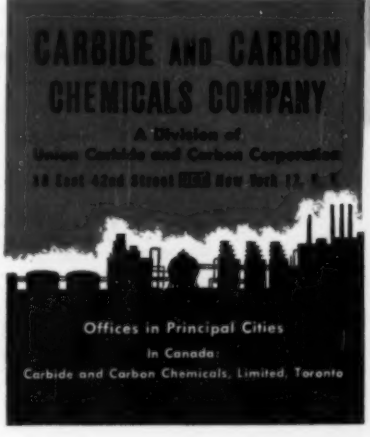
Try this versatile chemical now.

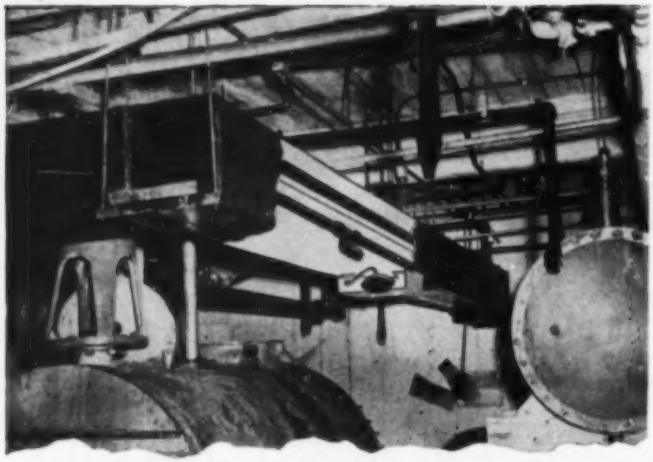
Call or write the nearest Carbide and Carbon Chemicals office *today* for samples or technical information on Diethylene Triamine.

Did you know that CARBIDE makes 68 other nitrogen compounds, including dimethyl ethanolamine, N-acetyl ethanolamine, and N-aminopropyl morpholine. For a complete list, ask for a copy of the booklet "Physical Properties of Synthetic Organic Chemicals," F-6136.

PHYSICAL PROPERTIES

Molecular Weight	103.17
Specific Gravity at 20/20°C	0.9542
Boiling Point at 760 mm. Hg	206.7°C.
Vapor Pressure at 20°C	0.2 mm. Hg
Freezing Point	−39°C.
Solubility in Water at 20°C	complete
Absolute Viscosity at 20°C	7.1 cps.
Flash Point (Cleveland open cup)	215°F.


CARBIDE AND CARBON CHEMICALS COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street New York 17, N. Y.
Offices in Principal Cities
In Canada:
Carbide and Carbon Chemicals, Limited, Toronto



FOR CHEMICAL PROCESSING OPERATIONS...

Automatic FIRE-FOG PROTECTION BEFORE

IT WARNS IT ISOLATES IT DRENCHES

FIRE OR EXPLOSION

The use of certain chemicals in the manufacture of synthetics creates extremely dangerous fire hazard problems. Recognizing the need for maximum fire safety at the chemical processing operations shown, a new type of Automatic FIRE-FOG system was designed and installed. The system will detect a rupture in the process piping, immediately apply a water cooling spray of protection and will flush the flammable material to a safe location before the possibility of fire or explosion can occur. System operation is automatic and standard rate-of-temperature-rise heat detectors are employed. Vapor detectors are also used in conjunction with this type of system.

This typifies the design advantages of fire protection by Automatic Sprinkler. In many instances, actual hazardous conditions are simulated at our Testing Grounds. "Mock-ups" of the equipment to be protected are built and fire tests run, using the actual flammable materials involved.

It is this basic engineering, plus test and field experience that has earned for Automatic Sprinkler the reputation—leaders in the science of fire protection.

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 1, OHIO

"Automatic" Sprinkler
FIRST IN FIRE PROTECTION

DEVELOPMENT . ENGINEERING MANUFACTURE . INSTALLATION
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

as a high solids spraying solution and a trowel cement is sold under the name of Neobon and is being used to protect against abrasion and corrosive solutions. Product is available in experimental quantities and unlimited quantities with proper priority ratings.

Resin for All Pulps

Economy, ease of use, fast wet strength off the machine. (170A)

A new approach to the economical production of wet-strength paper is forecast by the Rohm and Haas Co., with the development of a cationic wet-strength resin of unusual properties.

Designated as Uformite 700, the new nitrogenous resin offers excellent curing characteristics in a variety of pulps and over an extremely broad range of resin concentrations in the pulp. Whether at high or low levels of concentration, it is said to produce war tensile strength economically, with rapid development of strength after the paper leaves the paper machine.

Heretofore high early wet strength has been possible only with resins requiring acid treatment and aging in special acid-resistant equipment. A major advantage claimed for the new resin is that it requires no special mixing procedures or equipment. Product dilutes readily with water and is then ready for use.

The new resin appears to perform well on all types of pulp—bleached and unbleached, kraft and sulphite—with no sensitivity to the sulphate ion concentration in the water. Because of its high stability, Uformite 700 may be stored in the same manner as are conventional liquid wet-strength resins. Thus it may merit consideration where bulk storage and shipment are desirable.

Improved Tall Oil

Low cost, improved properties. (170B)

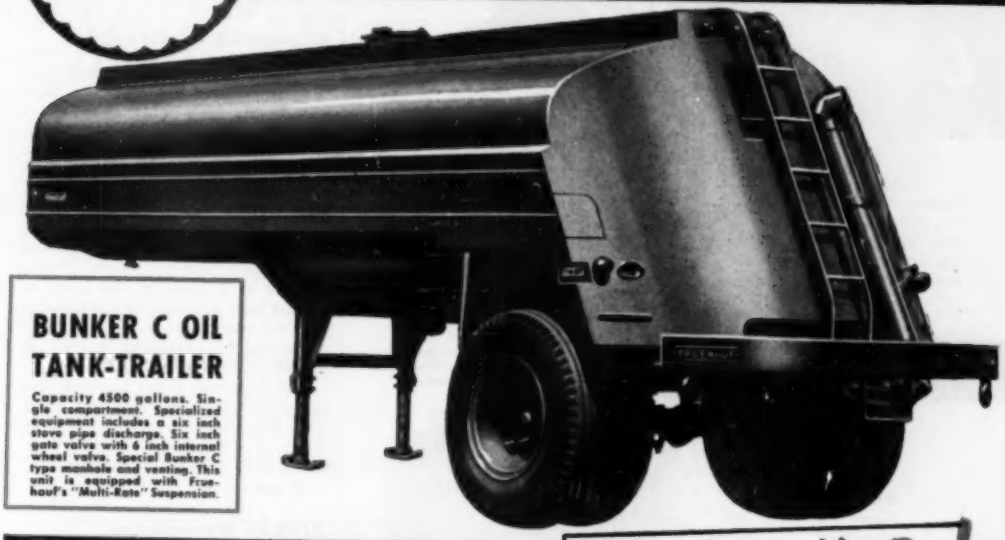
Ardex PE is the name chosen for an improved tall oil developed by Archer-Daniels-Midland Co.

The company claims the product to be the lowest priced general purpose bodied oil on the market. Compared with the company's old tall oil, it offers lighter color, improved film properties and greater uniformity.

The oil is esterified with pentaerythritol for a fast, hard dry and higher chemical resistance. It is recommended for use as a checking oil

(*Continued*)

SOLVED Another LIQUID HAULING PROBLEM with FRUEHAUF TANK-TRAILERS



BUNKER C OIL TANK-TRAILER

Capacity 4500 gallons. Single compartment. Specialized equipment includes a six inch stove pipe discharge. Six inch gate valve with 6 inch internal wheel valve. Special Bunker C type manhole and venting. This unit is equipped with Fruehauf's "Multi-Rate" Suspension.

FRUEHAUF has, or can build, a TANK-TRAILER for every liquid hauling need!

The problems of hauling chemicals and chemical products are many and varied, *and each demands special requirements* of the vessel containing it. For this reason most chemical hauling tanks are "Specials". Fruehauf, the leading builder of Tank-Trailers, has probably built a unit with special features to haul your load, and . . . with all the outstanding qualities of a Fruehauf. *Strength, durability* and *light weight* are never sacrificed for special load carrying features.

Your Problem May Be DIFFERENT!

When you have a *special* problem of hauling, let Fruehauf build a Tank-Trailer for your particular needs. Problems such as flow, temperature and safety are solved by a staff of Trailer Engineers, and the unit built by skilled Fruehauf technicians. The result is an economical, long-lived Tank-Trailer built for the job, and backed by the world's largest builder of Truck-Trailers.

A new and comprehensive guide-book on Tank-Trailers is available upon request. It illustrates and describes many chemical hauling units as well as the standard line of Fruehauf Tank-Trailers.

WRITE

FRUEHAUF TRAILER COMPANY

10964 HARPER AVENUE

DETROIT 32, MICHIGAN

FRUEHAUF Trailers

"ENGINEERED TRANSPORTATION"

WORLD'S LARGEST BUILDERS OF TRUCK-TRAILERS

HELICOID Chemical Gage

Standard dials: 0-15, 30, 60, 100, 150, 200, 300, 400, 500, 600, 800, 1000, 1500, 2000, 3000. Also 0-30" vac., 15 and vac., 30 and vac., 60 and vac.

Removable bottom port and Diaphragm ring available for

Supplied with Cartridge Snubber in socket for pump service.

Bronze
Cast Iron
Lead Coated Iron
Steel
Stainless Steel (316)
Monel
Hastelloy B
Hastelloy C
Dural (24 S-T)
Carpenter No. 20 (Durimet)
Nickel
Everdur
Hard Rubber

Here's a chemical gage for any pressure to 3,000 p.s.i. and also for vacuum or compound ranges, and temperatures to 300° F. Particularly suitable for chemicals and other viscous liquids that either corrode or clog a Bourdon tube gage.

One feature of this Chemical Gage is that the diaphragm is made of "TEFLON" which is flexible and resists practically all corrosive chemicals. No fragile metal foils are used. The diaphragm chamber is supplied of any metal most suitable for the service.

Available in the following dial sizes: 4½", 6", or 8½". 1" female N.P.T. bottom connection. Flanged connection also supplied.

HELICOID

ACCO

Only Helicoid Pressure Gages have the Helicoid Movement

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE COMPANY, INC.
Bridgeport 2, Connecticut

TRADE MARK

in varnishes and as a modifier in flat, semi-gloss and full gloss systems, and as a wood preservative.

Color of Ardex PE ranges from 10 to 12 (Gardner). Acid number is 10-20, viscosity (G-H), Z_6-Z_7 and weight, 8.31 lb. per gal.

Expanded Perlite Fines

Filler, aggregate, insecticide carrier. Inert, low cost, low bulk density, high insulating value. (172A)

Expanded perlite, the volcanic glass that's made like popcorn, is being offered by the Ozark-Mahoning Co.

The materials (Jan. 1950, p. 92), essentially aluminum silicate, are of interest as a filler for paints, plastics and the like. They are also useful as a filter aid, aggregate for insulating cements and blocks, as an insecticide carrier and an ingredient in scouring and cleansing powders.

The fines have a very low bulk density—5 to 15 lb./cu. ft.; make excellent insulating materials, are inert, fireproof, verminproof, etc.

Price—3¢ per lb., available in carload quantities.

Alykyl Phosphites

Diethyl, Dibutyl, Triethyl, Tributyl Phosphites, joined by two more. Additives, intermediates, stabilizers. (172B)

To the above named compounds, marketed by Virginia-Carolina Chemical Co., have been added di-2-ethylhexyl, and tri-2-ethylhexyl Phosphite.

The materials offer interesting possibilities as intermediates in the synthesis of organic phosphorus compounds. They are useful also: (1) As additives to lubricating oils, to serve as corrosion inhibitors, stabilizers and antioxidants. (2) In extreme pressure lubricants, to improve such factors as viscosity, film strength, load carrying capacity, penetrability, and to retard wearing, scuffing and seizing of bearing surfaces. (3) As stabilizers, plasticizers, and antistatic agents in cellulosic materials.

Dyes for Iron Cores

Eliminate time-consuming marking of cores by engraving, embossing or paint. (172C)

Metals cannot be dyed—that is, with the exception of carbonyl iron powder. General Aniline and Film Iron Powders recently announced the successful

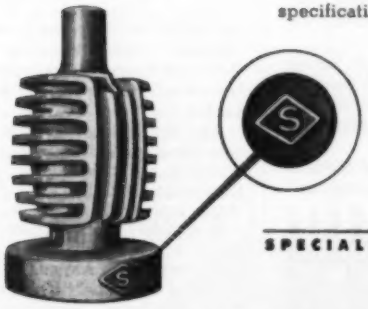
(*Continued*)

a *SHARP* eye for shapes

Any man has an eye for a shape like this (whistle) . . . but it takes more than natural instinct to have a trained eye for the blueprint precision of a casting pattern. Sivyer techniques produce castings that are true to every minute detail of pattern contour and dimension. This painstaking fidelity to pattern eliminates much handling . . . extra processing on your part. It is just one of many reasons why engineers with a sharp eye for better casting values choose Sivyer.

how to be sure of pattern-true castings—

Look for the Sivyer Ⓢ—your guarantee of accurate and specification steel castings. Inquiries promptly handled.



SIVYER

SPECIALISTS IN HIGH ALLOY AND SPECIFICATION STEEL CASTINGS

SIVYER STEEL CASTING COMPANY • MILWAUKEE Ⓢ CHICAGO Ⓢ

A COMPLETE TECHNICAL SERVICE
by ANSUL
EFFECTIVE AND ECONOMICAL USES OF SO_2
IN A VARIETY OF INDUSTRIES
ANSUL
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IN INDUSTRY
GRAIN
PAPER
GLASS
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Sulfur Dioxide
ANSUL
99.98%
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PURE
• REG. U. S. PAT. OFF.
Ansul's Technical Service gives you the benefits of improved process efficiencies and quality control when using Ansul Liquid Sulfur Dioxide.
New uses of liquid sulfur dioxide are continually being developed. It's HIGH PURITY, GREATER ECONOMY, AND EASE OF CONTROL provide a versatile and effective chemical to a great variety of industries.
To compliment the availability of liquid sulfur dioxide, Ansul has cataloged years of experience and research to provide a complete technical service covering present and potential uses of SO_2 in industry.
Write for File No. 300 and ask for specific information concerning your own application.
CONSULT ANSUL'S STAFF of trained and experienced Chemical Engineers.
If you have a problem or process involving acidifying, neutralizing, bleaching, preserving, dechlorinating, reducing, deoxidizing, etc., Ansul's Engineers can be of service to you.
Call on them for assistance, without cost or obligation.
ANSUL CHEMICAL COMPANY
INDUSTRIAL CHEMICAL DIVISION, MARINETTE, WISCONSIN

development of a group of dyestuffs that can be incorporated with the carbonyl iron powder in core production to identify various types of cores for special uses.

The new core dyes are stable under humidity, temperature, and a wide range of molding pressures. They show their colors in all shapes and over long periods of time.

General Dyestuff Corp. does not claim that the dyes will increase magnetic permeability. Less iron means less permeability, but the percentage of the strong dyes is very small and the small reduction of permeability is offset by the sure identification of cores, saving of time now used for other means of marking, and simplification of assembly procedure in the production of electronic equipment.

Flameproof Orlon

Resists high temperatures. May be useful in military gear, firefighters' clothing. (174A)

Orlon, Du Pont's second newest fiber, has a brand new property—discovered by accident. A piece of the cloth was left in an oven, heated to 275 deg. F., emerged black but otherwise intact.

This immediately set off a progression of conjectures. It might be used in parachutes dropping equipment over enemy territory. Incendiary bullets could not set such a parachute aflame.

Product is limited to a black color which would rule it out for flameproof decoration in the home but industrial plants could conceivably welcome the material where fire hazards are present.

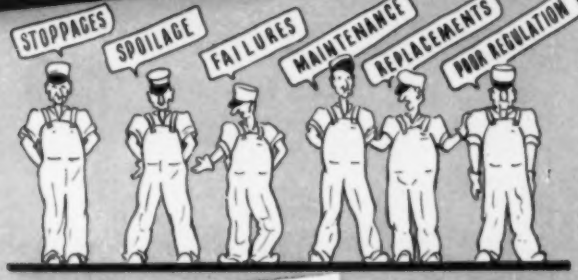
Ceramic Metal Coating

Protection against oxidation up to 2,400 deg. F. Resists corrosive liquids, thermal shock. (174B)

A new ceramic coating for metals and alloys that withstands oxidation, corrosion, flexing, vibration, percussion, and severe thermal shocks has been developed by Elraco Engineering Co.

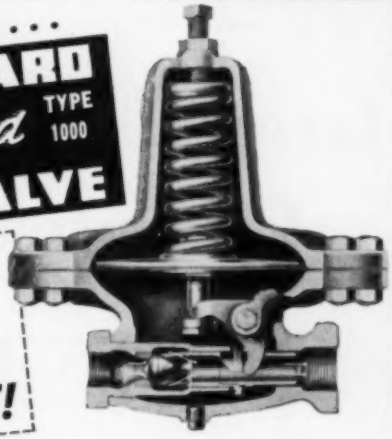
The new coating, known as Elkote, provides a protective barrier against corrosion and oxidation at temperatures up to 2,400 deg. F. It also withstands prolonged immersion in corrosive liquids. The product adheres firmly to metals of widely different coefficients of expansion, even when subjected to flexing, percussion, vibration and sudden extreme temperature changes. —*End*

THESE ARE THE TROUBLEMAKERS YOU WISH TO STOP . . . .



HERE IS THE VALVE THAT WILL STOP THEM . . . .

CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000



THIS IS THE BULLETIN (No. 962) THAT TELLS YOU WHY . . . .

SEND FOR IT!

and here is proof from a user . . . .

"We are more than satisfied with our STREAMLINED Valve performance. They are all over this plant and, frankly, I have forgotten about most of them as I never have any trouble.

"What I like about these valves is that in some cases our initial pressures vary considerably, yet the reduced pressure is held steady. This work is all processing and is very important.

"Your competitors will have a hard time convincing me there is a better valve to be had."

THESE ARE THE BENEFITS YOU GET BECAUSE OF ITS ASPIRATOR AND STREAMLINED FLOW . . . . .

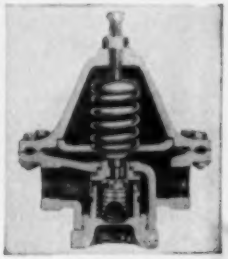
Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions • Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

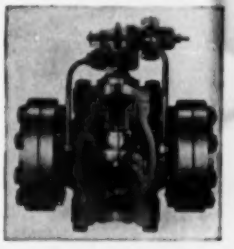
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

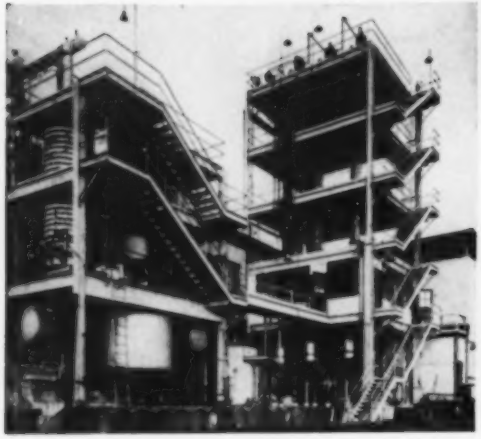


Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.

Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.



Polyvinylpyrrolidone is only one of a host of acetylene derivatives made at this GAF plant in Grasselli, N. J.

Substitute for blood plasma is prime market for this chemical. Production involves other acetylene chemicals.

Acetylene Chemicals

A CHEMICAL ENGINEERING PICTURED FLOWSHEET

This is the way General Aniline & Film Corp. makes polyvinylpyrrolidone. This blood plasma substitue is produced at Grasselli, N. J. Recent expansion at GAF's plant has focused attention on the many reactions that can be put to work when acetylene is harnessed.

Raw materials used in production of polyvinylpyrrolidone are calcium carbide, formaldehyde, hydrogen, and ammonia.

Calcium carbide is placed in a traditional acetylene generator where it reacts with water to give the acetylene needed for the process. Acetylene and formaldehyde are combined by ethynylation to produce butynediol. Products from the reactor are fed to a separator where unreacted acetylene is recycled, then the remaining formaldehyde is removed in a stripping still. Butynediol solution is next run through a hydrogenation unit to form butanediol. Next step is formation of butyrolactone.

After formation of the hetrocyclic ring, the butyrolactone is run into an amination unit. Here ammonia reacts with it to form pyrrolidone. This intermediate is vinylated in the presence of an alkaline catalyst. Every precaution is taken to keep the vinyl pyrrolidone thus formed chemically pure. Final distillation takes place in a stainless steel vacuum tower, the storage and measuring tanks are glass lined. In the polymerization step the kettle is stainless steel. Glass-lined or stainless dilution kettles receive the polyvinylpyrrolidone. The polymer is diluted with pyrogen-free distilled water and pumped to a spray dryer. The polyvinylpyrrolidone is a fine white powder. This powder is prepared as an isotonic solution buffered to an approximate pH of 7.0 and after sterilization is used as a synthetic blood plasma.

Reactions in the Process

Acetylene generation

A $CaC_2 + 2H_2O \longrightarrow HC \equiv CH + Ca(OH)_2$

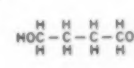
Ethynylation

B $HC \equiv CH + 2HCO \longrightarrow HOC-C \equiv C-COH$

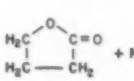
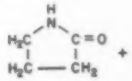
Hydrogenation

C $HOC-C \equiv C-COH + 2H_2 \longrightarrow HOC-C-C-COH$

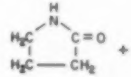
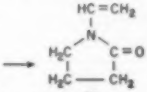
Dehydrogenation

D $HOC-C-C-COH \longrightarrow$  $+ 2H_2$

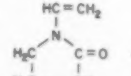
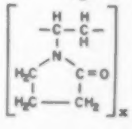
Amination

E  $+ NH_3 \longrightarrow$  $+ H_2O$

Vinylation

F  $+ HC \equiv CH \longrightarrow$ 

Polymerization

G  $\longrightarrow$ 

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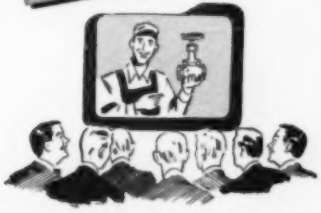
which saves time and effort in selecting valves for common piping services.



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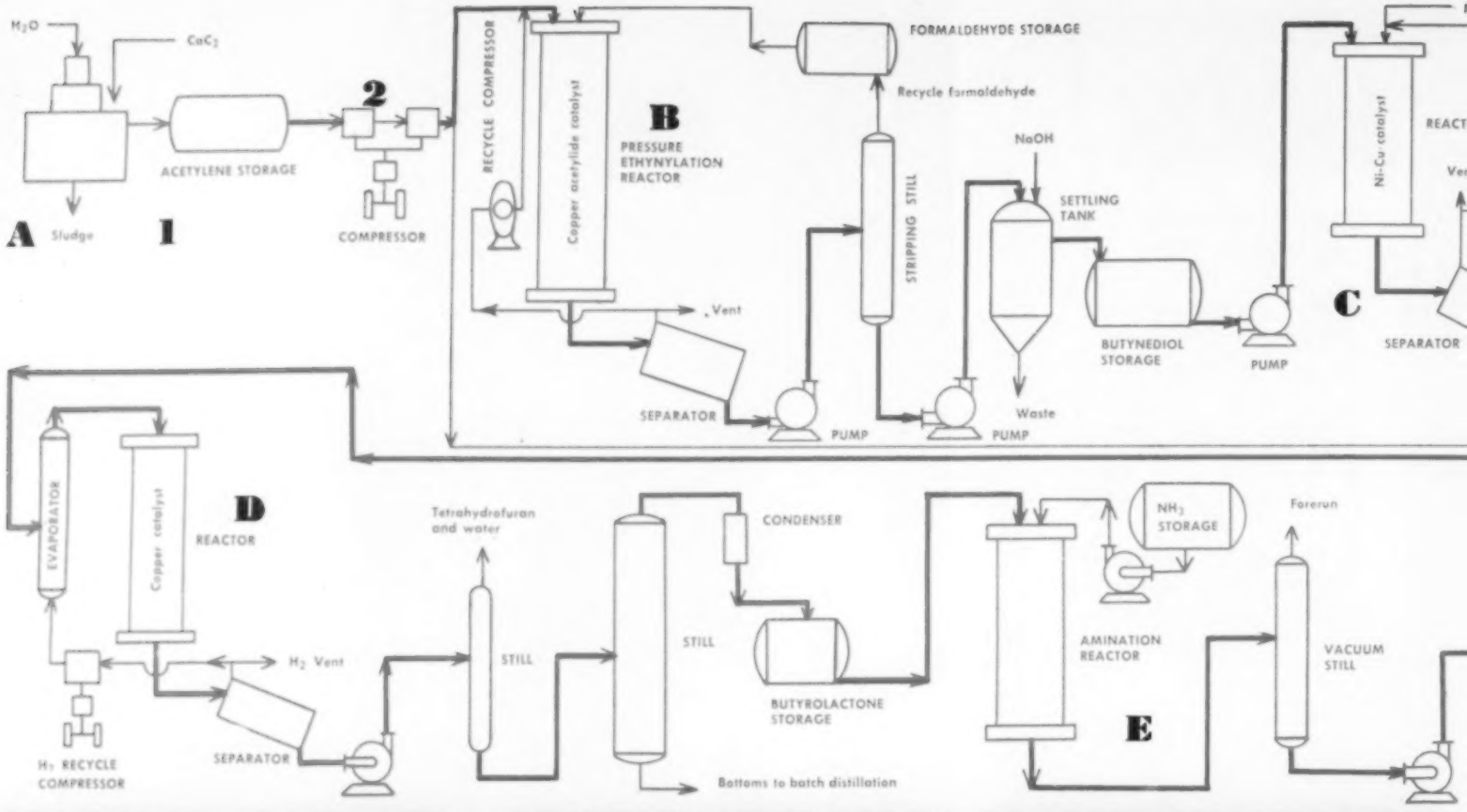
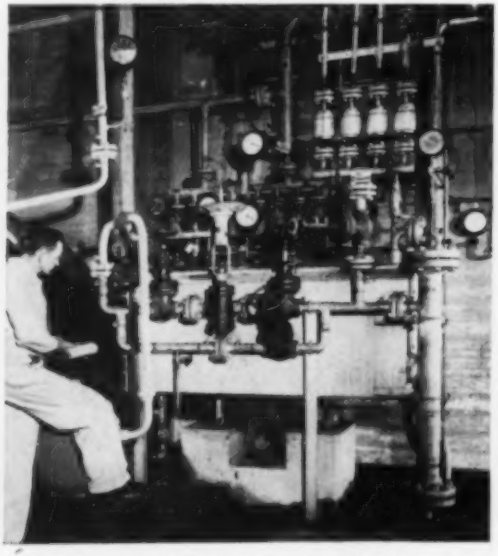
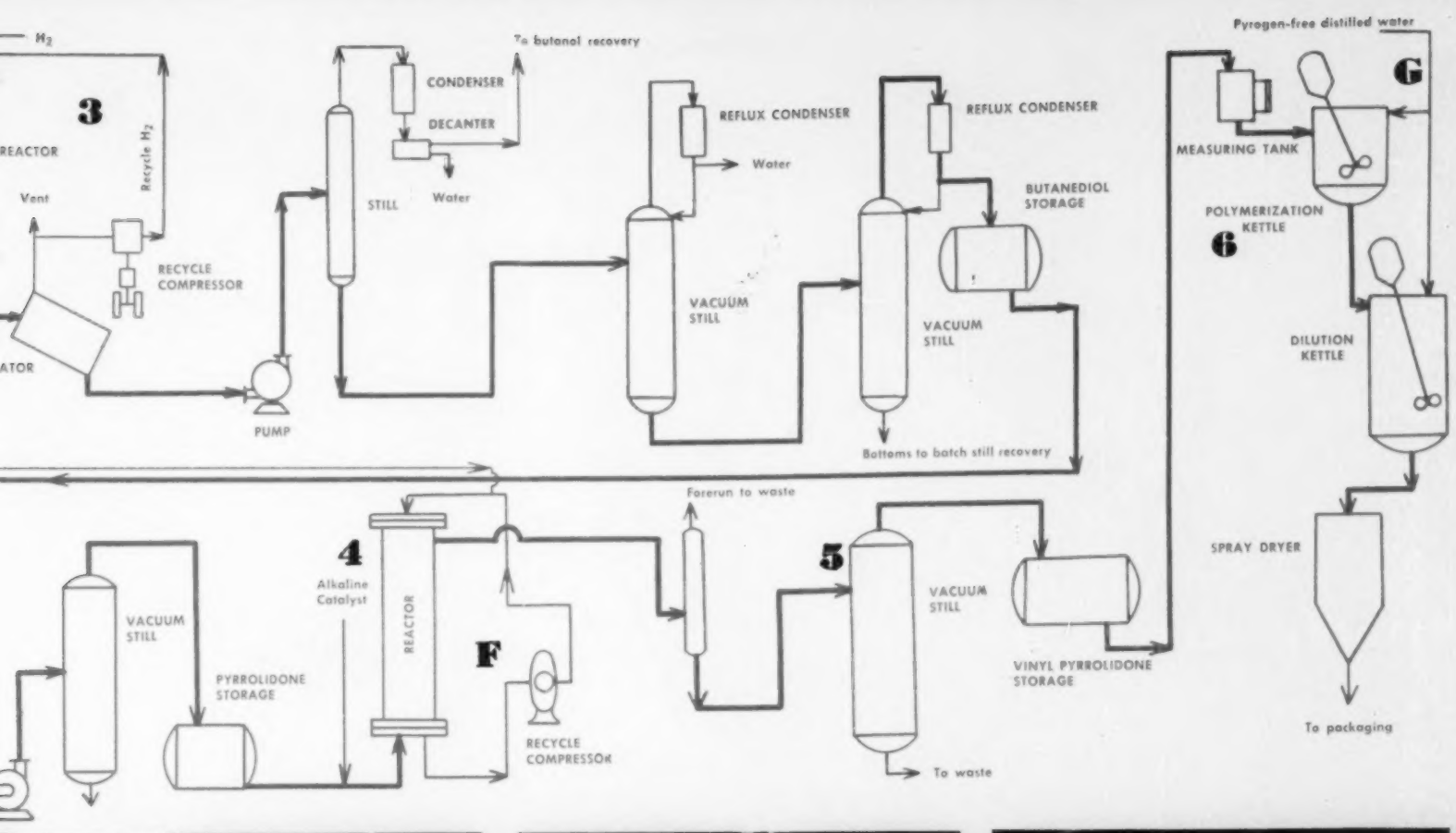


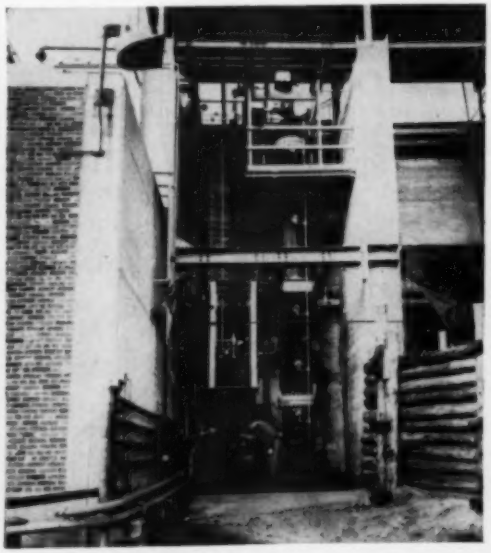
1 Acetylene is produced in this bank of generators to feed the reactors with the prime raw material.



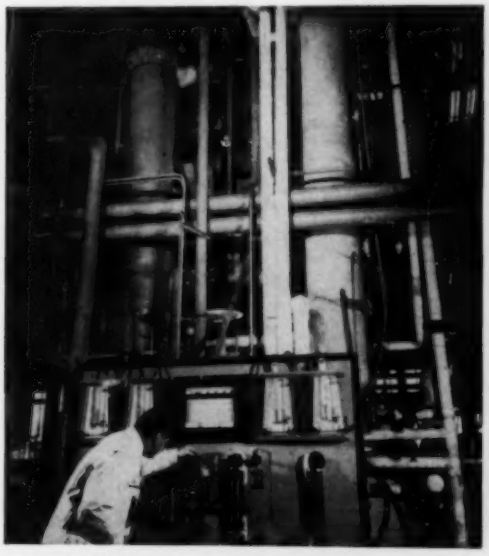
2 Compression is important in pressure synthesis. This multi-stage compressor keeps reaction pressure up.

3 Reactor controls are located behind explosion-proof bulkheads in a central corridor for safety.



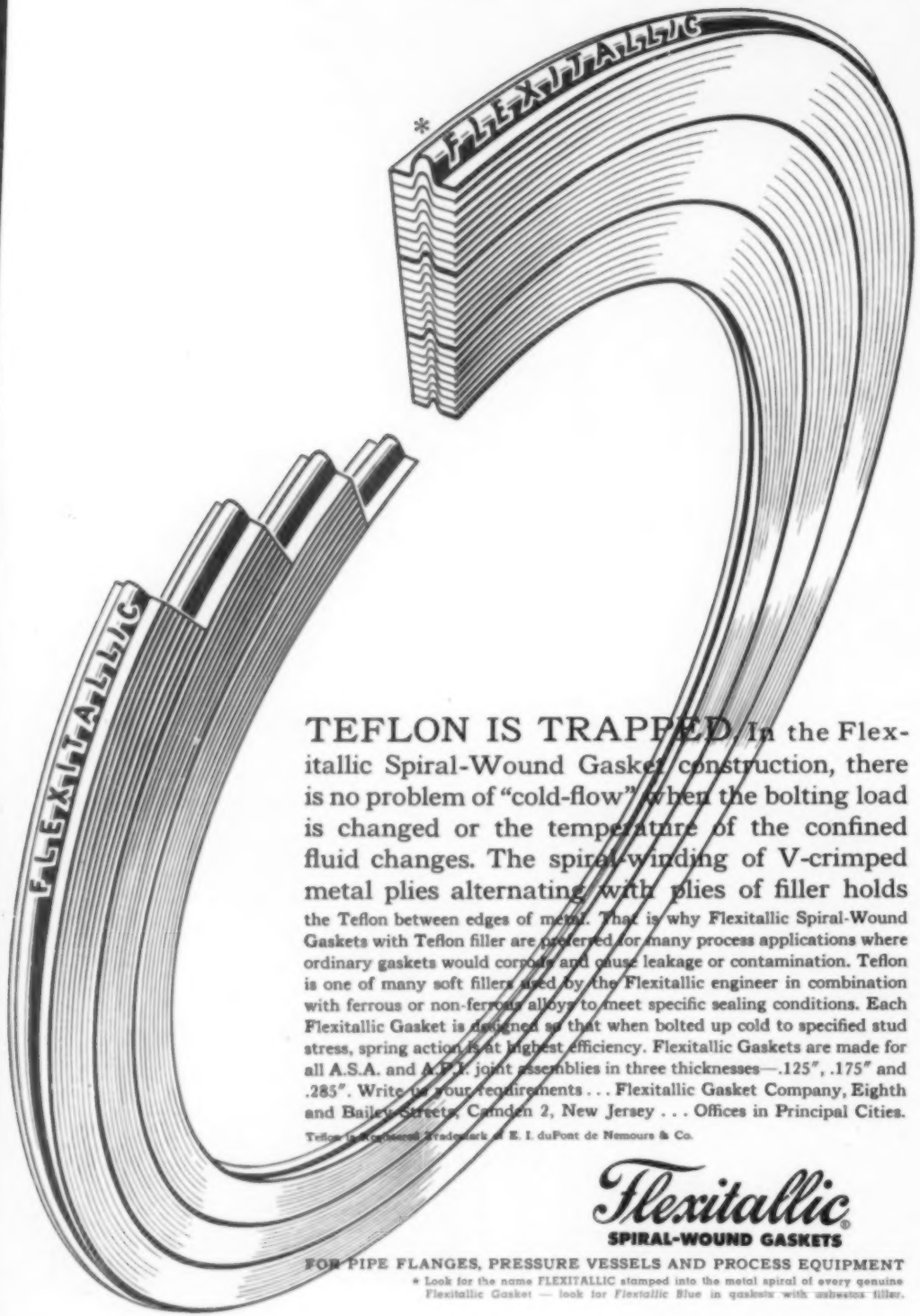


4 Reactors designed for high-pressures are used to carry out acetylene chemistry of process.



5 Distillation is an important part of each reaction stage. Several stills are used. Some are 50 ft. high.

6 Polymerization of vinylpyrrolidone is important. Molecular weight must be kept within limits.



TEFLON IS TRAPPED In the Flexitallic Spiral-Wound Gasket construction, there is no problem of "cold-flow" when the bolting load is changed or the temperature of the confined fluid changes. The spiral-winding of V-crimped metal plies alternating with plies of filler holds

the Teflon between edges of metal. That is why Flexitallic Spiral-Wound Gaskets with Teflon filler are preferred for many process applications where ordinary gaskets would corrode and cause leakage or contamination. Teflon is one of many soft fillers used by the Flexitallic engineer in combination with ferrous or non-ferrous alloys to meet specific sealing conditions. Each Flexitallic Gasket is designed so that when bolted up cold to specified stud stress, spring action is at highest efficiency. Flexitallic Gaskets are made for all A.S.A. and A.P.I. joint assemblies in three thicknesses—.125", .175" and .285". Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey . . . Offices in Principal Cities.

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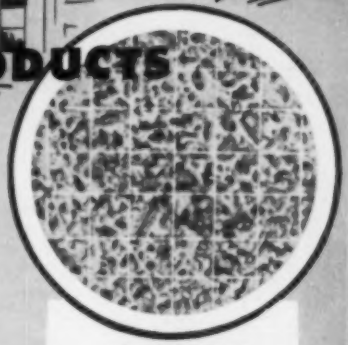

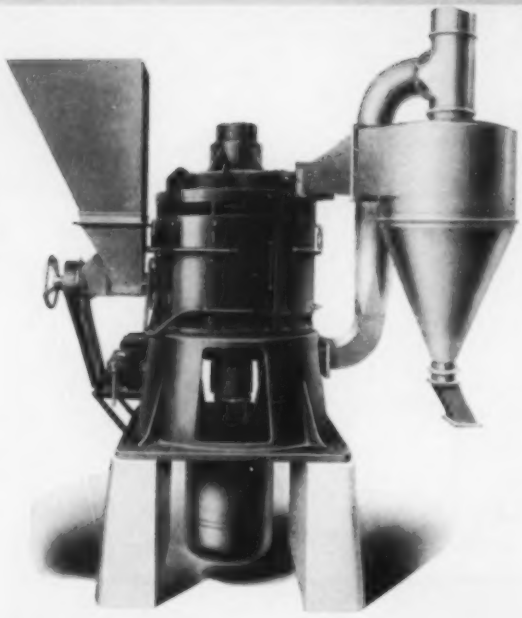

UNIFORM POWDERED MATERIALS produced in Sub-Sieve Sizes

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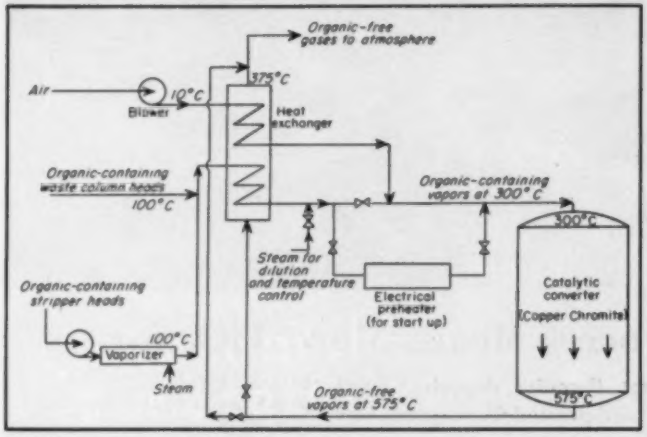
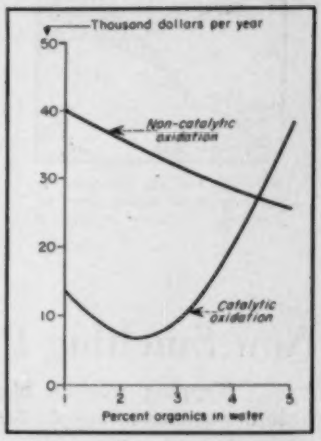


PROCESS at Belle eliminates pollution problems of two organic waste streams.



COSTS favor the new catalytic process.

New Catalytic Process Oxidizes Wastes

Du Pont reveals a vapor-phase catalytic process to destroy the oxygen-consuming properties of wastes by oxidizing organic content to carbon dioxide and water.

A new process for destructive catalytic oxidation of organic wastes has just been put into operation at Du Pont's Belle, W. Va., plant. The unit uses a copper chromite catalyst and vapor-phase treatment. It is believed to be the first large-scale unit of its kind to destroy non-hydrocarbon organic wastes by catalytic action.

Technique to be used at Belle, which was originated by Technical Superintendent D. V. Moses,* opens up a new field of organic pollution control that may often pan out to be (1) more convenient than biological treatment and (2) cheaper than non-catalytic oxidation at high temperatures.

What's more significant, it's hinted that the process may be adapted to the treatment of organic-containing liquids as well as vapors.

Although initial investment for the Du Pont catalytic oxidation process is usually 20-30 percent higher than for an incinerator, operating costs are lower (see chart). Under the most favorable condition (a waste with 2.5 percent organics) these costs may be only 15-20 percent as much as for incineration. Operating costs of the two processes become about equal when the organic content in the waste reaches 4.5 percent.

Du Pont will use the process at Belle (see flowsheet) to treat two types of waste: (1) vapors from a distillation column that consist of 96.5 percent water and 3.5 percent organics —formaldehyde, methanol and formic acid; (2) vapors from another column that consist of 92 percent water and 8 percent ethylene glycol derivatives.

Since one of the columns operates under a vacuum, the distillate is condensed, pumped back up to the operating pressure of the oxidation unit and vaporized. The other stream has a pressure high enough that it can be forced through the unit. Air and the streams of organic wastes are passed separately through the heat exchanger to avoid possible flashback or combustion in the exchanger. They are heated to about 300 deg. C. by the hot vapors from the converter.

The heated streams of air and organic wastes pass through the converter. This contains a copper chromite catalyst formed by pilling with graphite, then burning out the graphite.

Since the oxidation reaction is exothermic, the gases leave the converter at about 575 deg. C. After going through the heat exchanger they are reduced to about 375 deg. C. Since practically all of the organics are oxidized to CO_2 and water, the treated vapors can be vented directly into the atmosphere.

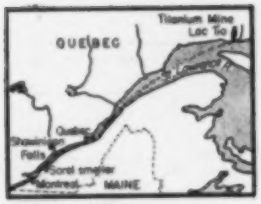
Under proper conditions of temperature and space velocity, essentially 100 percent conversion can be expected even after a catalyst life of 1,000 hr. Care must be taken to keep the temperature below 600 deg. C. to prevent sintering of the catalyst surface. A 1 percent increase in methanol content will raise the temperature of the exit gases about 75 deg. C.

At 300 deg. C. or above, copper chromite can tolerate small concentrations of sulphur. On most of the catalysts tested, sulphur poisoning is particularly bad at 200-250 deg. C.

Du Pont engineers have done a lot of work, of course, on the oxidation of other organic materials and the use of different types of catalysts.

Materials that can be catalytically oxidized: methanol, formic acid, acetic acid, adipic acid, formaldehyde, acetone, benzene, cyclohexanone, ethylene glycol, hexamethylene diamine, and n-caproic acid. Catalysts that have shown activity are the oxides of copper, chromium, manganese, nickel and cobalt.

* And revealed by Assistant Technical Superintendent Ralph V. Green at the recent conference of the Manufacturing Chemists' Association on air and water pollution.



ROUTE: Lac Tio ore comes by rail from mine, thence down St. Lawrence to smelter at Sorel. ▶

New Smelting Process Means More TiO_2 for Us

Tapping world's biggest ilmenite deposits, Sorel becomes source of supply for hard-pressed U. S. producers of titanium pigments.

Titanium-rich slag from Canada will soon be reaching U. S. producers of titanium dioxide pigment. It will be recovered from ilmenite ore by a new smelting process that also produces a high-grade melting iron.

Ore from Canada's vast deposits will move by rail 27 mi. through the wilderness from Lac Tio, Quebec, to Havre St. Pierre and then by oreboat down 500 mi. to the new smelter at Sorel. Several shiploads have already been discharged. Ore will be mined at the rate of 3,000 tons a day for the seven warm months.

The new treatment plant at Sorel will handle 550,000 tons of ilmenite ore per year when it reaches full production at the end of 1952. Its products will be 200,000 tons per year of iron and 270,000 tons of slag with more than 70 percent TiO_2.

Quebec Iron & Titanium Corp., two-thirds owned by Kennecott Copper Corp. and one-third by New Jersey Zinc Co., will operate the mines and treatment plant. More than $30 million has been pumped into the project so far. Fraser-Brace Cos., design engineers and constructors, built the ore railroad and smelter.

Sorel's furnaces will be the first for the large-scale electric smelting of titaniferous ores with the intent of recovering the titanium dioxide. Up to now, titanium dioxide and iron have been separated either by a combination of mechanical and chemical processes or by normal smelting where only iron was recovered; the titanium dioxide was discarded in the slag.

First furnace of five contemplated was operated experimentally last October, was shut down for rebuilding in March this year. Construction of the other four is progressing on schedule.

To power Sorel, Shawinigan Water & Power Co. strung a 40-mi., 220,000-v. transmission line that will supply 160,000 hp.—more than 10 percent of Shawinigan's present generating capacity.

Slag output of the plant will be shipped to titanium pigment producers in the United States. Present major U. S. producers: National Lead, Du Pont, American Cyanamid and Glidden. New Jersey Zinc may join them. These companies will make titanium dioxide from the slag.

The project has vital strategic and economic importance. Exploitation of the deposits in the Allard Lake region of Quebec—the world's largest, with over 125 million tons of ilmenite ore—will free us from dependence on such overseas sources as the black sands of India. The new smelting process will make titanium dioxide available for use as a pigment, now in heavy demand, or for transformation into titanium metal.

Up to now, smelting of titaniferous ores has always required addition of large quantities of such fluxes as lime, soda or alumina to counteract the thickening of the slag caused by the presence of lower-valenced titanium oxides. But fluxes dilute the slag, make it uneconomical to recover the titanium content.

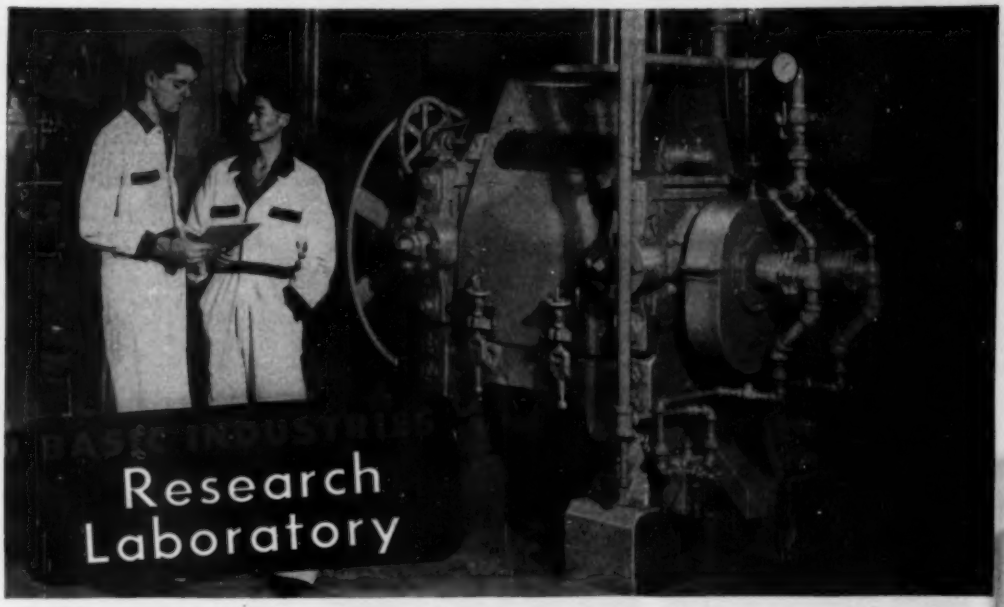
It's the necessity of obtaining a fluid slag, high in TiO_2, with just the proper amount of reduction, that has required the development of a high degree of control over charge composition and furnace operation.

Secret of Quebec Iron's success: control of the charge composition and furnace conditions so that little or no flux need be added. Maximum amount of lime added is 10 percent of ore by weight, preferably not more than 6 percent, and varying from that down to none at all. This gives a marketable melting iron and a titanium-rich slag, suitable for acid digestion and leaching.

Contrary to conventional smelting practice, an excess of coal is avoided. The amount added is slightly less than that theoretically required to reduce the iron oxide in the ore to iron and to carburize the iron, with the oxidation of carbon to carbon monoxide. In general, this will range from 8 to 14 percent of ore weight.

Outstanding characteristic of the slag is its high titanium content—60 to 70 percent TiO_2. Iron oxide content, as Fe, ranges from only 2 to 20 percent; CaO from 14 to 18 percent. Total of these two impurities is only 5 to 20 percent. In addition, the slag has digesting properties that lead to the recovery of 80 to 85 percent of the titanium dioxide present in the leach solution.

Its low iron content, compared with concentrates currently used, cuts the amount of sulphuric acid required per pound of output. What's more, pigment can be obtained directly from the leach solution without, as in ilmenite processing, crystallizing out part of the iron as ferrous sulphate. This cuts digestion and leaching time in half and pares cost. It also does



How Lab Tests Helped Develop New Product

A PHARMACEUTICAL manufacturer had developed a vegetable gum — derived from seeds of a tropical plant — which was in considerable demand for use as a base in medicines, foods and paper sizings.

The gum had been successfully extracted and cleaned. The resultant product, however, was excessively gummy. Unless a way could be found to render it suitable for grinding, it could not be put up in a marketable form.

This problem was brought to the Basic Industries Laboratory. After preliminary experiments, it was found that a carefully controlled flaking mill process could produce a product that was sufficiently friable to be ground easily.

Batch tests were followed by a pilot mill test which indicated that the process would be commercially practical.

As a result of the laboratory tests, this manufacturer was able to proceed with confidence in setting up full-scale equipment for this process.

CAN YOU USE THESE FACILITIES?

The Allis-Chalmers Basic Industries Laboratory was established to help you work out profitable solutions to processing problems. It contains modern equipment for batch and pilot mill tests in grinding, crushing, sizing, concentrating, jigging, pyro-processing, chemical and physical analysis.

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Facilities of the Laboratory are available to anyone in industry. Charges are based on costs. Estimates for test work can be obtained from A-C district offices or from Allis-Chalmers Basic Industries Laboratory, Milwaukee 1, Wis.

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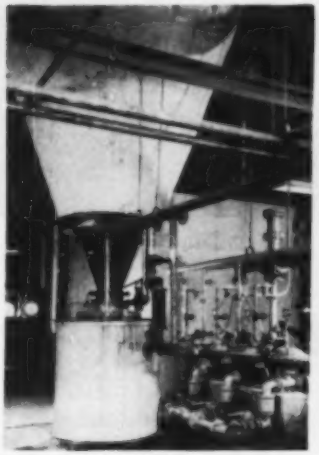
away with byproduct ferrous sulphate, for which there's little market.

The five stationary smelting furnaces at Sorel, largest ever with sprung roofs, are a departure from normal electric furnace design. They are box-shaped with six electrodes in line instead of cylindrical with three electrodes in a triangle. This makes for larger capacity. Continuously fed and batch-tapped, the furnaces will each treat 300 tons per day of ore.

Crushed ore, coal and flux are fed into the electric furnaces. Heated to 2,700 to 3,100 deg. F., the iron melts and separates from the slag, which floats on the surface. When the furnace is tapped the iron flows into a 25-ton ladle; the slag overflows into a cast steel slag pot. After the sulphur content of the iron is brought down with lime in one of two smaller 60-ton electric arc tilting furnaces, the resulting high-grade melting iron is cast into ingots. The slag is cast into small blocks and crushed before shipment.

In making pigment, slag will be digested with 93 percent sulphuric acid. The mixture is agitated with air and heated to 100 deg. F. Reaction occurs between the slag and the acid, converting the titanium to the soluble sulphate. The reaction mass is then dissolved in water. From the leach solution hydrated TiO_2 can be recovered by hydrolysis. Heating with steam hydrolyzes 95 percent of the titanium present. A series of filtrations and washings follow. The hydrate is calcined in a continuous rotary kiln at about 1,650 deg. F. to get the titanium dioxide. Final treatment consists of dispersion in water, wet grinding, thickening, filtering, drying and air separating.



PROCESS: spray dryer cuts time cycle.

PRODUCT: microspheres resist wear.

Spray Dryer Speeds Up Process

Davison Chemical's new spray dryer at Cincinnati —largest of its kind ever built—cuts catalyst processing time 93 percent, turns out a superior microspheroidal product for cat crackers.

Petroleum refiners making aviation and motor gasolines by fluid catalytic cracking now have a new source of microspheroidal catalyst: the recently completed unit of Davison Chemical Co. at Cincinnati.

Cincinnati now becomes Davison's largest catalyst plant—and Davison, in turn, is the country's biggest (and pioneer) producer of synthetic cat cracking catalysts for the petroleum industry. The firm's total catalyst capacity is now close to 40,000 tons a year.

The microspheroidal product (see cut) made at Davison's new unit is often preferred over the older ground-and-sized type of catalyst. Since it has rounded surfaces and uniform particle dimensions, it is more resistant to attrition. This is important to the petroleum refiner: his losses of catalyst—a relatively expensive factor in fluid cat cracking—are cut down.

Besides, the spray drying technique slashes 67 hr. from the catalyst-making process: Davison can now make microspheroidal cat cracking catalyst at Cincinnati in only 5 hr. whereas it requires 72 hr. to make the older dried-and-ground product at its Curtis Bay, Md., plant.

Here's how Davison now makes its synthetic microspheroidal catalyst at Cincinnati:

Weak solutions of sodium silicate and H_2SO_4 are combined in a venturi mixer to give a hydrosol that sets within a few minutes. The slurry is agitated in an open wooden tank for about 15 min., then sent to another similar tank where a small amount of H_2SO_4 is added.

It then goes to a third tank where a small amount of NH_4 is added, then to a fourth where it receives an aluminum sulphate solution. Aqua ammonia is added to it in a fifth tank: this precipitates alumina.

Slurry (with alumina, ammonium sulphate, sodium sulphate and other impurities) is pumped to a drum-type filter. The cake from this is mulled in paddle-type equipment to give a pumpable slurry that will not harden even if it is not kept thoroughly agitated.

Mulled silica-alumina slurry is pumped at 5,000 psi. through a series of nozzles in the top of a spray dryer. This is a cone-shaped Swenson unit 22 ft. in diameter and 50 ft. high—largest of its kind yet built. Slurry droplets pass down through a stream of hot flue gases moving in the opposite direction. The dryer operates at about 700 deg. F. Exit gases pass through a water scrubber to (1) remove any catalyst carried out of the spray chamber and (2) to prevent air pollution.

Dried catalyst from the bottom of the spray dryer (see cut) is wetted and pumped to an Oliver horizontal filter. Here it is washed to remove ammonium sulphate and other soluble impurities. The filter is a stainless steel unit 15 ft. in diameter. It has vacuum pumps and units for recycling the solution around the filter in a precise schedule.

This filter cake is 50 percent solid catalyst and 50 percent water. It is dried in a typical direct-fired rotary unit equipped with cyclone dust collectors. The microspheroidal catalyst product now goes to one of three storage silos. From these it is loaded into closed hopper cars and shipped to petroleum catalytic cracking units throughout the country.

Southwest Success Story

The establishment and growth of the steel industry in the Southwest is an example of another great industry being attracted by the myriad of advantages offered by the area. Vast natural resources, assured low-cost power, temperate climate, and land centrally located for low-cost distribution offered management the geographical area ideal.

When the steel industry decided on expanding its facilities in the Southwest, it naturally sought out Brown & Root, Inc., for the engineering and construction work.

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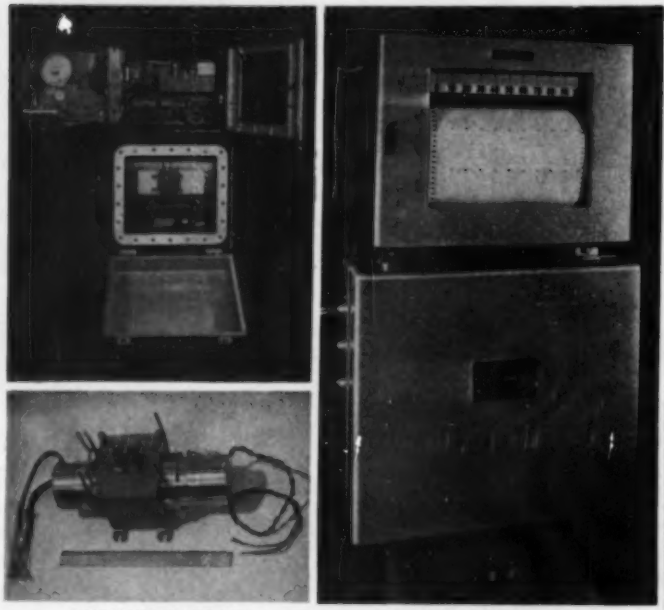

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Production Can't Keep Pace With Methyl Chloride Wants

Consumption of methyl chloride is fast outstripping increased production, industry officials warned the NPA at a recent Washington meeting. Allocation may become necessary, but so far NPA has made no decision.

Big uses are in the production of silicone rubber, other synthetic rubber and as a refrigerant. Methyl chloride is also used in drugs and insecticides.

Production increases during the past year range from 20 percent to 100 percent. Even so, industry is hard pressed to fill orders.

Estimated 1951 demand for methyl chloride will total 42,591,000 lb., about 5,355,000 lb. more than expected production, the NPA figures. Added capacity will come in this fall, but it will be absorbed by new and growing uses.

Spokesmen for Du Pont, Belle Alkali, Ansul Chemical and Dow said their companies need advance notice on orders. NPA agreed to set a lead time of 15 or 20 days for producers.

If methyl chloride is allocated by issuance of a schedule to M-45, it will probably be classed as an Appendix B material, requiring the producer to get authorization from NPA to fill an order. The application would specify end uses of the chemical.

Major Awarded IRI Medal For Research at Merck

Dr. Randolph T. Major, vice president and scientific director of Merck & Co., Inc., was awarded the 1951 medal of the Industrial Research Institute at the annual award dinner May 15 at the Shoreham Hotel, Washington, D. C. The presentation was a highlight of the three-day annual meeting.

Under Dr. Major, Merck has done outstanding research and development work on vitamins, including B_{12}. The research program developed since he came to the company, largely under his direction, also played an important part in bringing into general use the antibiotics, many of the sulfa drugs, and cortisone.

Major joined Merck as a consultant in 1929, and between 1930 and 1936 served as director of pure research. He was director of research and development between 1936 and 1947, and since that year has headed all Merck's scientific activities as vice president and scientific director.

Major was cited "for his skill in building an outstanding industrial research organization, for his vision in

guiding it to the timely solution of worthy problems in human health, nutrition and welfare, for his successful integration of fundamental scientific research with the operations of his company and with the public interest, and for his leadership in bringing about close cooperation between government and university research groups and his own laboratories in the attainment of these goals."

Standard of Indiana Doubles Output of Missouri Refinery

Capacity for processing crude oil at its Sugar Creek, Mo., refinery will be increased from 38,000 to 68,000 bbl. per day, says Vice President M. G. Paulus of Standard Oil Co. (Ind.).

Preliminary construction work is now under way, but most of it will be done later this year and next. The expansion should be completed by the end of 1952.

Major unit to be installed is a large combination crude-running and coking unit; it will be located adjacent to the catalytic cracking and

(Continued)

CONVENTION CALENDAR

American Pharmaceutical Association, Statler Hotel, Buffalo, August 26-31.

International Congress of Pure & Applied Chemistry, New York, September 9-11.

American Institute of Chemical Engineers, regional meeting, Shearton Hotel, Rochester, N. Y., September 16-19.

Drug, Chemical & Allied Trades Section, New York Board of Trade, annual meeting, Shawnee-on-Delaware, Pa., September 20-22.

World Metallurgical Congress, in conjunction with National Metal Congress and National Metal Exposition, Detroit, October 15-19.

American Association of Textile Chemists & Colorists, annual meeting, Statler Hotel, New York, October 17-19.

Association of Consulting Chemists & Chemical Engineers, annual meeting, Shelburne Hotel, New York, October 23.

National Paint, Varnish & Lacquer Association, Chalfonte-Haddon Hall, Atlantic City, October 29-31.

Federation of Paint & Varnish Production Clubs, annual meeting, Chalfonte-Haddon Hall, Atlantic City, November 1-3.

American Petroleum Institute, annual meeting, Chicago, November 5-8.

American Council of Commercial Laboratories, Baker Hotel, Dallas, November 15-16.

Chemical Specialties Manufacturers Association, annual meeting, Mayflower Hotel, Washington, D. C., December 2-4.

American Institute of Chemical Engineers, annual meeting, Chalfonte-Haddon Hall, December 2-5.

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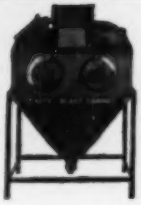

Blast Cleaning Cabinet quickly and easily cleans rust, grime, dirt, paint, etc., from metal parts. Produces a clean, smooth surface on pieces up to 60" x 36". Models available from $315.00 and up.

Blast Cleaning Machine not only removes rust, dirt, scale, etc., but is ideal for maintenance and many other uses. Cleans large objects such as bridges, structural work, tanks before painting. Six sizes, portable or stationary, from $170.00 and up.

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Unit Dust Collector stops dust at its source, minimizes machine wear and tear, reduces housekeeping and general maintenance costs. Solves many grinding and polishing nuisances. Reduces material losses. Models from $286.00 and up.

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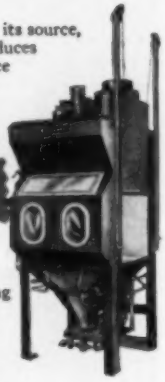

Hydro-Finish Cabinet uses liquid blast, eliminating dust, and reduces costly hand polishing, cleaning and finishing of molds, dies, tools, etc. Removes scale, discoloration and directional grinding lines, prepares surfaces for plating and coating. Holds tolerances to .0001". Models from $1295.00 and up.

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- ☐ Blast Cleaning Machines
- ☐ Unit Dust Collectors
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City.....Zone.....State.....

vapor recovery units installed at Sugar Creek in 1948. Capacity of several auxiliary processing units will be increased.

Largest Prilling Towers Make Nitrate for Spencer

A new ammonium nitrate prilling plant—largest of its kind in the world—has just been put into operation by Spencer Chemical Co. at its Jayhawk works near Pittsburg, Kan. Capacity of the two towers (one will not be completed until August) will be more than 1,000 tons of fertilizer-grade prilled nitrate per day.

Concentrated ammonium nitrate solution is dropped down large 185-ft. high towers (see cut) countercurrent to a flow of cool air. By the time it reaches the bottom, the nitrate has solidified into small spheres or prills—a form with considerable advantages as a fertilizer material.

Spencer's plant is based on the prilling processes originated in Canada by Consolidated Mining & Smelting Co. But the actual design, which has a number of unique features, was developed by Spencer engineers. Construction was by Quaker Valley Constructors, Inc., a Spencer subsidiary.

Since Spencer's Jayhawk works is already a major producer of ammonia and fertilizer ammoniating solutions, the addition of fertilizer-grade prilled ammonium nitrate now makes this plant a completely integrated operation.

Louisiana Carbon Black Unit Has Capacity of 12,500 Tons

Now beginning operations is the new $2,000,000 carbon black plant of Continental Oil Black Co. near Lake Charles, La. Annual capacity

will be 25,000,000 lb. of high-abrasion furnace black. It will use petroleum raw materials.

Output of the plant will go largely into synthetic rubber—especially "cold rubber." The reactivated synthetic rubber industry has upped the demand for high-abrasion furnace blacks.

Continental Oil Black Co. is a joint enterprise of Continental Carbon Co. and Continental Oil Co. The product will be distributed by Witco Chemical Co.

Dow Boosts Ethanolamine Capacity 30 Percent

More ethanolamines will soon be coming from Dow Chemical's plant at Midland, Mich. The increase will be close to 30 percent for mono-, di- and triethanolamines.

This is Dow's third expansion in alkanolamine capacity since World War II. Total production from the two U. S. producers is now estimated to be near 30,000,000 lb. annually—an increase of almost 275 percent since 1940.

Dow believes the next few years will see a sharp increase in ethanolamine consumption for recovering hydrogen sulphide from sour natural gases. But it also expects to see a larger tonnage of these chemicals go into the manufacture of synthetic detergents and into the recovery of carbon dioxide. Triethanolamine has a substantial outlet in the manufacture of agricultural sprays and 2,4-D liquid herbicides.

Ethanolamines are made by the ammonolysis of ethylene oxide. The reaction is exothermic; operating temperature is usually about 50-60 deg. C. The proportions of mono-, di- and triethanolamines in the reaction mixture depend on process conditions and the ratio of ammonia to ethylene oxide. Excess oxide favors the formation of triethanolamine.

Coastal Tankers to Carry Benzene to Styrene Plant

Crude benzene will be shipped from Seattle, Wash., by tanker to the Gardena, Calif., plant of Dow Chemical Co., where it will be used to make styrene for synthetic rubber. Entire benzene production of Seattle Gas Co., amounting to nearly 1.5 million gallons a year, will be taken by Dow.

Benzene will be piped 2,000 ft. through a 3-in. pipe from the Seattle Gas Co. to a 10,000-bbl. steel tank on the Lake Union waterfront for shipment by tanker. Dow is spending an estimated $50,000 on the Seattle installation. Until the tank installation can be completed, the benzene is going by tank car. (*Continued*)

In One Year

PANGBORN DUST CONTROL

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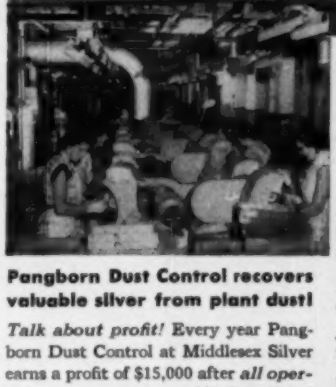
Heart of profitable dust control at Middlesex Silver is a Pangborn CJ Collector like this. Shown above in a cutaway view are the filters which make the CJ ideal for heavy loading applications like this.



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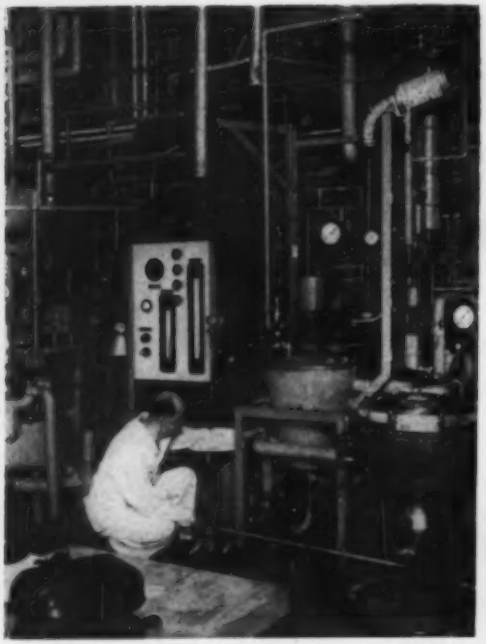
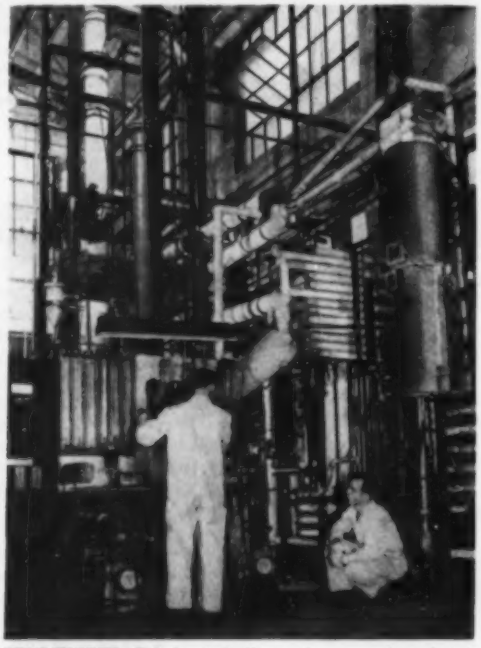


EXPERIMENTAL: technical service laboratory. Each technical researcher requires an investment of approximately $33,000.

PILOT PLANT: spray dryer. In 1950 Du Pont spent $38 million—3 percent of gross sales—on research, excluding construction.



SEMI-WORKS: Polychemicals Dept. One research project in twenty reaches commercial success; one dollar in five pays off.

Du Pont's Engineers at Research...

Last month Du Pont opened its new, enlarged and consolidated Experimental Station laboratories near Wilmington. This research center is now probably the largest of any chemical company in this country. Chemical engineers are prominent throughout its nine separate laboratory buildings.

In 1924 Du Pont's Experimental Station represented a total investment of $500,000; now it is $40,000,000. Then the station had a force of 50 technically trained people; now it is over 800. Yet the company has 1,000 more technical researchers in 31 laboratories scattered throughout the nation.

At the Station's new Engineering Research Laboratory, chemical engineers have as their objective the development of less costly and more efficient chemical manufacturing plants through (1) more exact engineering information, (2) new or better equipment, (3) greater knowledge of construction materials, (4) improved construction materials, (5) new or improved devices for continuously measuring, analyzing, recording and controlling process variables.

"The research people of Du Pont make up an organization of which we are extremely proud . . . (they are) our most promising hope for the future," says President Crawford Greenewalt, himself once a research chemical engineer at the station.

"As long as the nation's laboratories are active, there can be no mature economy—there can be only growth and improvement."

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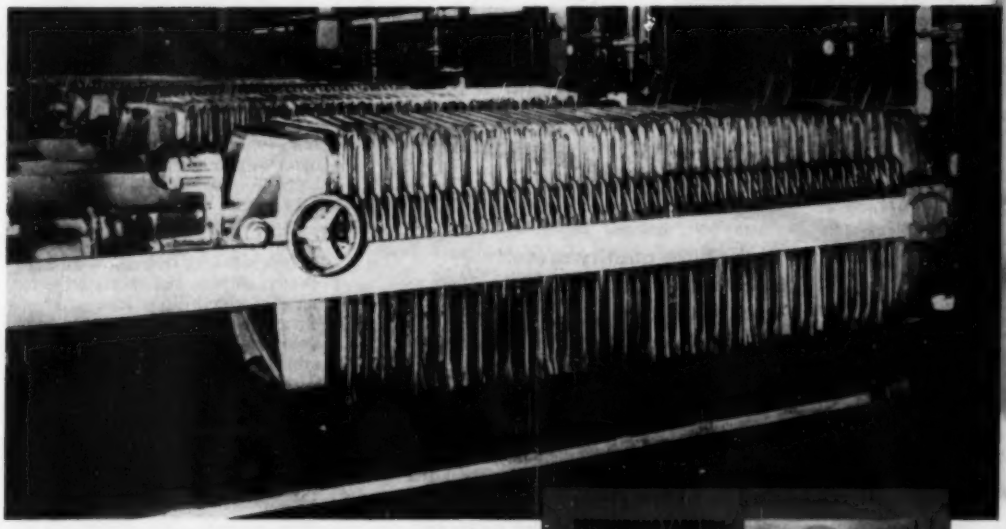

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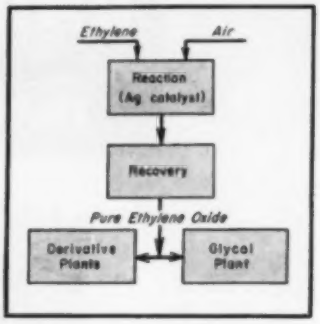

Oxidation Process Pares Cost of Ethylene Oxide

A practical process, developed by Scientific Design Co. of New York, is now generally available to the chemical industry for the production of ethylene oxide at high yields by direct oxidation of ethylene.

The new process pares the cost of producing ethylene oxide by at least 25 percent. And Scientific Design engineers say it gives higher yields than other direct oxidation processes.

Right now, with defense-vital chlorine scarce, the new process is particularly timely. It uses no chlorine, as does the chlorhydrin process, which takes on an industry-wide basis more than 600 tons per day. Instead, it simply oxidizes ethylene with air, using a silver catalyst, to produce essentially pure ethylene oxide (see cut).

In the chlorhydrin process, ethylene is first chlorhydrinated and then hydrolyzed with calcium hydroxide. Water, chlorine and ethylene are fed into a chlorhydrin tower. Hypochlorous acid, formed from the chlorine and water, reacts with the ethylene to form ethylene chlorhydrin. The liquid product, usually containing about 5 percent chlorhydrin, is pumped to a hydrolyzer. There a hydrated lime solution is run into the chlorhydrin and steam is blown through the mixture to yield ethylene oxide and an aqueous solution of calcium chloride. Also present are residual chlorhydrin, dichloroethyl ether and ethylene dichloride. Distillation separates the ethylene oxide.

How does the new direct oxidation process stack up against the chlorhydrin process?

It produces a purer ethylene oxide that gives better colored derivatives.

It's much less corrosive than the chlorhydrin process.

There are no inevitable byproducts as there are in the chlorhydrin process. You don't have to make and sell

dichloroethyl ether and ethylene dichloride.

There's no troublesome calcium chloride waste disposal problem. Getting rid of the calcium chloride waste from the chlorhydrin process is an acute and growing problem, particularly with state and federal authorities bearing down on pollution caused by chemical manufacturing.

There's a 1.75 lb. net loss of chlorine in the chlorhydrin process. It takes 2 lb. of chlorine to make 1 lb. of ethylene oxide by that method, and much of it winds up in calcium chloride. The direct oxidation process uses no chlorine.

Novel features claimed by Scientific Design for its process are: (1) specially designed equipment; (2) improvements in the silver catalyst; (3) refinements in conditions of reaction and recovery; (4) continuity of operation, which minimizes maintenance; (5) a utilities balance that makes the process a low utilities consumer; (6) general reduction in capital costs; and (7) increased yield.

The process was researched, developed and pilot-planted over a five-year period. Part of the work was done in cooperation with Petrocarbon Ltd. of Manchester, England.

ECA has just put up $855,000 for one of these ethylene oxide units in France as part of a $12 million petrochemical expansion at L'Etang de Berre for Societe Naphtachimie. The unit will produce 8,000 tons per year of ethylene oxide by direct oxidation. It will substitute for a previously planned chlorhydrin unit.

How about U. S. customers for such plants? Scientific Design keeps pretty mum about this, covly admits only that it has some nibbles.

NPA Shapes Plan for Pulp and Paper Makers

A plan to help the pulp and paper industry meet its increasing production problems and to ease the current pulp shortage is being worked out by the National Production Authority.

The proposed NPA order would: (1) limit producers' inventories of market pulp to from 30 to 45 days; (2) limit the use of pulp to about 90 percent of former use to effect a saving of some 290,000 tons annually; (3) limit, by quota, the export of pulp; (4) order integrated mills to reserve about 3 percent of production for non-integrated mills in the U. S.

NPA is working with the Office of Price Stabilization on measures to ease the shortage brought about by the increased prices of Scandinavian pulp.

Shortage of sulphur is likely to cause cutbacks in paper production.

(Continued)

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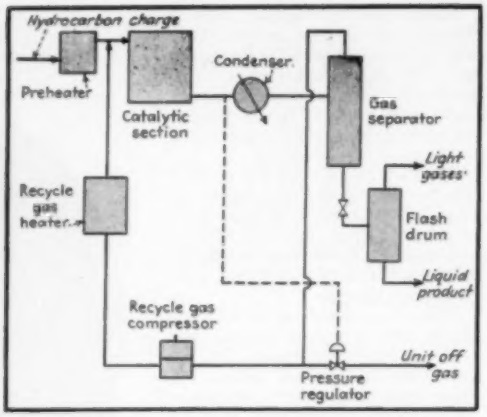
MULTIBED ADIABATIC pilot plant at Houdry's laboratory. Engineering studies for commercial plant are now under way.



HOUDRIFORMING process for continuous catalytic reforming of low-octane naphthas to benzene, toluene and xylenes.

Another Way to Get Aromatics

Houdry's new continuous catalytic process converts low-octane naphthas to aromatics or high-octane gasolines, gives high-purity hydrogen as byproduct.

Last month President D. N. Hauseman of Houdry Process Corp. in Philadelphia made public his firm's "Houdriforming"—a new process that promises much for the chemical and petroleum refining industries.

Houdriforming is a continuous process for catalytically reforming low-octane petroleum naphthas to aromatic concentrates and high-octane gasolines. It is now in an advanced state of pilot plant development, says Houdry's C. G. Kirkbride.* Detailed process design and mechanical engineering for commercial scale operation are under way.

The process has several important features: (1) Houdry-developed catalysts, made from commercially available materials, are dual in function and highly selective; (2) sulphur compounds are removed and do not otherwise affect the process; (3) high-purity hydrogen is produced in large amounts as a byproduct.

Houdry's development is particularly important at this time as it (1) offers another way to augment the world's short supply of benzene, toluene and xylene, (2) enables the petroleum refiner to reform—catalytically and continuously—the low-octane paraffin constituents of naphthas into high-octane constituents, (3) tends to offset the short supply of tetraethyl lead essential to today's high-octane fuels.

The catalysts, although capable of operating continuously for long periods without regeneration, can be regenerated in place. They are not affected by sulphur compounds, including thiophene. The catalysts are very selective for (1) dehydrogenation of C_6 ring naphthenes, (2) dehydro-isomerization of alkyl cyclopentanes, and (3) isomerization of normal and slightly branched paraffins into highly branched paraffins. Since little hydrocracking occurs, hydrogen of more than 97 percent purity is produced.

AROMATIC PRODUCTION

In life tests—30-50 days of continuous operation without regeneration or loss of catalyst activity—different charge stocks were processed in multibed adiabatic units (see cuts) at widely varying conditions. A 150-220 deg. F. cut of an East Texas type naphtha was used as base stock.

Naphthenes in this charge stock would allow a stoichiometric yield of 48.4 volume percent aromatics; actual yields in the liquid product ranged from 38 to 48 percent, in order of increasing severity. This is a conversion of 70-90 percent. Stoichiometric conversion is not directly attainable because of thermodynamic equilibrium factors.

Hydrogen recycle and off gas consists of 97.5-98.5 volume percent hydrogen at all conditions—a yield better than 90 percent of theoretical based on conversion of naphthenes to aromatics. This indicates the catalyst is selective, promotes very little hydrocracking. No change in catalyst activity could be detected even after 35 days of continuous operation.

Other stocks included C_6 fractions with up to 57 percent methyl cyclopentane. In addition to quantitative dehydrogenation of cyclohexane, major proportions of methyl cyclohexane were converted to benzene.

For most severe conditions on unusually wide boiling range charges, a catalyst deposit may accumulate slowly but the ability of the catalyst to be regenerated gives maximum flexibility. Thus a non-blocked out operation can be used for simultaneous production of benzene, toluene and xylenes.

GASOLINE PRODUCTION

Houdriforming upgrades motor gasoline by four reactions: (1) conversion of six-membered ring naphthenes to aromatics; (2) dehydro-isomerization of alkyl cyclopentanes to aromatics; (3) isomerization of straight chain or slightly branched paraffins to highly branched paraffins; (4) desulphurization of naphtha to improve the lead response. Isomerization function of the catalyst is important in attaining the high yield of high-octane reformate.

Conversion of naphthenes to aromatics improves the octane rating only in the case of higher boiling naphthenes (such as dimethyl cyclohexane to xylene). Thus it is desirable to use feed stocks that have been fraction-

* Before a joint meeting of the American Institute of Chemical Engineers and American Chemical Society in Tulsa on May 16.

At the BS&B factory . . . applying pressure until disc rupture occurs, to check actual rupture pressure against rated pressure of each disc.

Money Can't Buy A Complete Lot!

. . . because a generous, scientific sample of SAFETY HEAD discs is ruptured at the factory to assure you of precision pressure protection. This is only one of many checks developed through BS&B's long experience in the exclusive manufacture of these versatile over-pressure relief devices. You can rely on SAFETY HEADS for instant, accurate action when needed!

No other relief device acts as quickly . . . full pipe-size opening afforded after disc rupture. If you have equipment under pressure, you need SAFETY HEADS!

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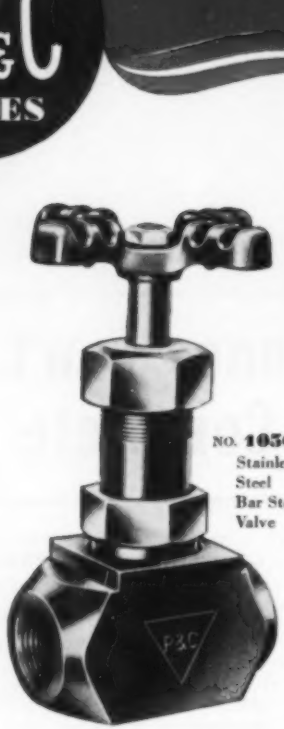

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R-P&C Bar Stock Valves are an achievement of the valve makers' craft. They are precision turned . . . from carefully tested metals . . . and suitable for a wide range of pressures and temperatures . . . for meter, gauge, test, and general purposes.

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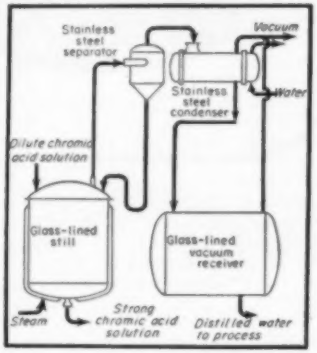
ated to include the maximum amount of naphthenes in a boiling range in which octane improvements can be obtained.

In the Houdriforming of a 180-370 deg. F. East Texas type naphtha, one catalyst gave a 78 volume percent yield of C_5 + 3 lb. RVP product of 97.3 octane number (F-1 clear). Octane number of the charge stock was 51.2. In this case, the catalyst had both dehydrogenation and isomerization functions.

Other catalysts, charge stocks and operating conditions naturally give different yields and product characteristics. Houdry engineers have investigated these conditions and are now doing engineering work for commercial scale operations.



New System Gives Economic Recovery of Chromic Acid

An economic system has now been developed to recover chromic acid from electroplating bath rinse water by direct evaporation. Five new units have recently been installed to use the process—developed by Pfaudler Co. of Rochester—and several more are planned to go in soon.

Pfaudler's recovery system is particularly important now since it (1) helps conserve the nation's supply of chromic acid and chromium chemicals, (2) eliminates a pollution problem at some electroplating works, (3) cut platers' operating costs by salvaging water as well as chromic acid. The process can be used wherever relatively pure but dilute solutions of chromic acid are formed.

Wash water with 1-6 oz. of chromic acid per gallon is concentrated back to plating strength—30-50 oz. per gal.—in a batch still under a vacuum of 26 in. of mercury and at about 125 deg. F. Entrained particles are caught and returned to the still by a cyclone separator. Condensate is

collected as distilled water for re-use in the plating operation.

The still—available in sizes up to 3,000 gal.—is lined with acid-resistant glass to prevent corrosive attack of the hot 25-45 percent chromic acid. Most other parts of the system can be made of Type 316 stainless steel.

One plant in Michigan, which once discarded 2.5 tons of chromic acid a month, found that the system paid for itself in six months. Besides, acid in the plant's over-all effluent was cut from 55 ppm. to 6-7 ppm. Actually, when a separator is used with the Pfaudler system, chromic acid at the vacuum receiver is cut down to 0-1 ppm. so that no acid is discarded.

Estimates show that an electroplating plant treating 300 batches a year of 1,000 gal. each can pile up annual savings close to $20,000.

Pipeline Authorized to Bring Gas to Salt Lake

Authority to construct a 400-mi. pipeline to bring natural gas to the growing industrial region around Salt Lake City has been granted to Utah Natural Gas Co. by the Public Service Commission of Utah. The 18-in. diameter pipeline would be strung from the Boundary Buttes territory of southeastern Utah to Salt Lake City. Its daily capacity: 76 million cubic feet.

Drilling rigs are being moved from Texas to Utah to develop gas wells in Emery County and San Juan County, says President John A. McGuire of the pipeline company. Byrd-Frost, Inc., of Dallas, Tex., is handling most of the drilling, and has already drilled exploratory wells along the pipeline route.

Great Lakes Carbon Puts Up 40 New Coke Ovens

Construction has started in St. Louis on 40 new coke ovens at the Merchant Coke Plant of Great Lakes Carbon Corp. The ovens, says President George Skakel, will increase the plant's capacity by approximately 75 percent.

When the expansion is completed in the summer of 1952, Great Lakes Carbon expects to be able to provide its customers with a steady supply of coke oven chemicals and of premium foundry and industrial coke. The present plant has been unable to meet the demand for these products.

Chemical products that will be recovered: coal tars, ammonium sulphate, nitration and industrial pure grades of benzene, toluene, xylene, crude light and heavy aromatic solvents.

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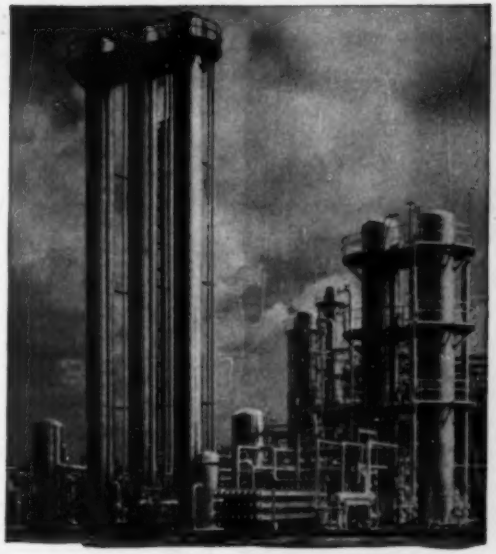

Southwest Gas Producing Co.—Uses

FLORITE

The recently completed gasoline plant of Southwest Gas Producing Company at Dubach, La., gathers wet gas from the surrounding area and employs new highly efficient methods for separating its ethane and propane components. Ninety million cubic feet of natural gas is handled daily, yielding a daily output of 230,000 gallons of liquefied hydrocarbons. The Fish Engineering Corporation of Houston designed and constructed this model plant.

In the two towers at the right of our illustration, wet gas is dehydrated with Florite and then passed to the three towers at the left for high-pressure absorption.

Floridin Products, adapted to a wide range of advanced industrial and technical uses, include several specially prepared forms of . . . . . .

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as well as two grades of Florite, which is a . . . .

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Your inquiry will be given careful attention.

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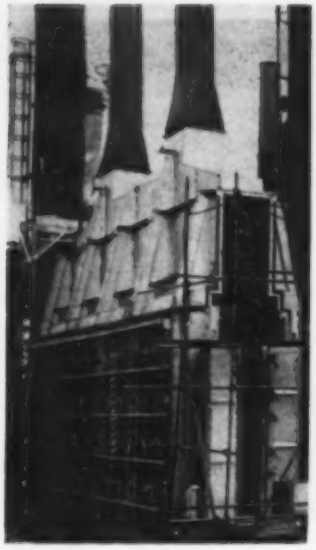
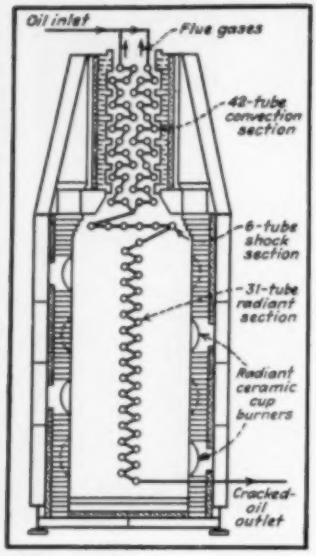


WHAT new unit looks like.



HOW new unit works.

Radiant Heater Cuts Costs

". . . has tremendous possibilities for both the large and small refiner. . ." says Phillips Petroleum about this newest development in radiant heating for petroleum processing.

More time, effort and money have been spent on heaters—petroleum engineers usually agree—than on any other one part of the integrated equipment that goes to make up a petroleum refinery.

Now all this may be changed by a new development in petroleum processing: a radiant-type heater that uses a flameless ceramic cup burner. A 30-million Btu. radiant unit at the Borger, Tex., refinery of Phillips Petroleum Co. has panned out so well that Phillips has now put in several additional units.

The new-type heater has big possibilities in (1) thermal cracking and visbreaking of gas oils, cycle oils and heavy oils, (2) thermal destruction of light hydrocarbons such as ethane and propane and (3) other uses where short residence times are essential. So says C. C. Tate, manager of Phillips' refining department.*

"Based on performance at Borger, radiant heaters can now give the refiner a high-efficiency furnace that (1) is easily installed, (2) has low maintenance and fuel costs, (3) gives smooth operation with high wind velocities, (4) can successfully process a wide variety of stock charges.

Selective heat input to the radiant coils produces higher heat transfer rates than in conventional heaters. This means a saving in initial tube costs, reduced residence time, high vapor velocities and low pressure drop.

The new heater has two sections: radiant and convection (see cut). The radiant section—about 38 ft. long, 5 ft. wide, 12 ft. high—has its coil placed midway between the sides. It consists of 31 tubes in two staggered rows. The tubes are 9 percent chrome steel.

Each wall in the radiant section has 56 flameless ceramic cup burners, each independently controlled. The cup is so shaped that the numerous small flames wipe the inner surface of the refractory plate and heat it to about 2,400 deg. F. This type of burner allows great flexibility in controlling the shape of the time-temperafure heating curve of the oil. The burners light easily, burn uniformly and require practically no attention from the operator. Since they have no moving parts, there is no maintenance problem.

The convection section—about 38 ft. long, 2 ft. wide, 7 ft. high—has its 42 tubes spaced on equilateral triangles in rows three and four tubes wide. Convection tubes are 7 percent chrome.

Oil enters the top of the furnace (see cut) and splits into two parallel streams that pass through the convection section countercurrent to the flue gases. They then join, pass through a six-tube shock section and through the radiant section.

A typical test on cracking gas oil at Borger shows (1) average radiant heat transfer rate of 17,000 Btu. per sq. ft. per hr., (2) average convection heat transfer rate of 4,920 Btu. per sq. ft. per hr., (3) heater efficiency of 81.5 percent, (4) only 9.2 percent excess air in the stack.

Low firebox temperatures—seldom above 1,550 deg. F.—together with the low percent of excess air should cut down oxidation of the furnace tubing and tube sheet material. The low excess air also reduces fuel costs—$15,000 or more a year on a 30-million Btu. unit with excess air cut from 100 percent to 10 percent.

In commercial runs on single-pass cracking of both catalytic cycle oil and virgin gas oil, the radiant heater gave conversions (gasoline plus gas) of 40-50 volume percent without excessive coil coking. In addition, it yielded a gasoline with a research octane rating 4-6 units higher than a similar charge stock thermally cracked with Borger's conventional heaters.

Finally, the new radiant heater gave excellent results in visbreaking heavy residuum from a high vacuum distillation process. Here, full advantage is taken of the unit's flexibility in controlling the shape of the time-temperature heating curve. Heat transfer rates as high as 40,000 Btu. per sq. ft. per hr. were calculated for the last tube in the furnace.

* Before the recent meeting of the Western Petroleum Refiners Association in San Antonio.

Alcoa Finds Laterite Likely Alumina Source

At the outset, Aluminum Co. of America will ship alumina from its Mobile, Ala., and East St. Louis, Ill., plants to its new $45 million reduction plant, to be built at Wenatchee, Wash., which will turn out 170 million pounds a year of aluminum. But there's a good chance that later on at least part of the alumina to be used at Wenatchee will come from laterite deposits in northwestern Oregon.

Alcoa has been investigating laterite as an alumina source for years, is still shipping the ore to East St. Louis for experimental work. What's been learned so far about laterite is encouraging, and Alcoa expects eventually to erect a plant in the Pacific Northwest to exploit the ore.

Stainless must go a long way, too!

To meet the demands of national defense and civilian needs, stainless must go a long way. That's why, now, more than ever—if you use stainless—use it wisely and efficiently.

Stainless is a name given to a broad list of grades and finishes—therefore, careful selection of the best available materials for your job is of prime importance. Here Crucible, a pioneer in the development of stainless steels, can help you get the most out of your share of stainless stocks through the unparalleled experience of our metallurgists and stainless fabricating specialists.

And when you can't get the grade of stainless you need, Crucible technical personnel can give you sound advice on the best available materials.

Until the time when stainless is more freely available . . . stretch your supplies of stainless. To do this . . . make use of Crucible's wealth of stainless steel experience.

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51 years of Fine steelmaking

STAINLESS STEELS

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STAINLESS • REX HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

INDUSTRY IS PROVING DAY "AC" DUST FILTERS

87% OF OUR PRODUCTION IS FOR REORDERS FROM . . .

FIRMS SUCH AS THESE:

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. . . and others.

THIS SUCCESS STORY SPEAKS FOR ITSELF

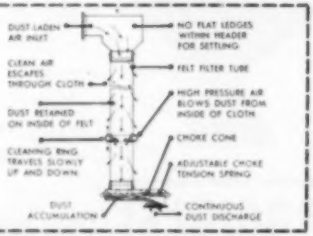
The soundness of the Day Type "AC" Dust Filter principle, effecting outstanding efficiency of operation with minimum maintenance, is verified by industry itself. 87% of our production of Day Type "AC" Dust Filters is channeled to meet the demands of users who are witnessing the results in their own plants—and reordering.

FEATURES OF THE DAY TYPE "AC" FILTER

- **CONTINUOUS-AUTOMATIC OPERATION** . . . the use of slow traveling, reverse jet cleaning rings gives automatic-continuous operation without shutdowns for cleaning.
- **CONSTANT AIR VOLUME** . . . the back pressure of DAY Dust Filters rises slightly when first started, then levels off to assure constant air volume.
- **PARALLEL AIR FLOW** . . . in the DAY Dust Filter, dust and air travel downward together.
- **HIGH AIR-TO-CLOTH RATIO** . . . 10, 15 or even 20 to 1 ratios maintained with uniform back pressures.
- **HIGH CLEANING EFFICIENCY** . . . with reverse jet cleaning, high grade filtering materials can be used because the action is gentle yet positive. Reverse jet rings move up and down, cleaning continuously.
- **NO DUST-CATCHING LEDGES** . . . DAY TYPE "AC" FILTERS, with a pattern of square-to-round inlet fittings, have no flat surfaces where dust can accumulate and become contaminated.
- **OUTSTANDING ADAPTABILITY** . . . units can be furnished with multiples of 4 tubes; housed or unhoused (see illustration); can be applied for either pressure or vacuum.

SCHEMATIC OPERATING DESIGN

The reverse air jet mechanism provides uniform cleaning over the entire length of the tubes, and operates with a maximum cloth area loss of only 1⅓% at any time. Air volumes remain constant and there are no cleaning shutdowns to cause high back pressures and sharp air volume variations.


DUST-LADEN AIR INLET
NO FLAT LEDGES WITHIN HEADER FOR SETTLING
CLEAN AIR ESCAPES THROUGH CLOTH
FELT FILTER TUBE
HIGH PRESSURE AIR BLOWS DUST FROM INSIDE OF CLOTH
DUST RETAINED ON INSIDE OF FELT
CHOKE CONE
CLEANING RING TRAVELS SLOWLY UP AND DOWN
ADJUSTABLE CHOKE TENSION SPRING
DUST ACCUMULATION
CONTINUOUS DUST DISCHARGE

Write-to-**DAY** for Bulletin 491

SINCE 1881

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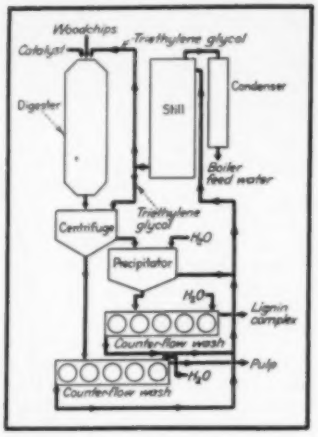

Glycol Extracts Lignin In New Pulping Process

A new solvent pulping process, using triethylene glycol, successfully extracts the lignin complex in wood, separating it from the cellulose, and also gives higher yields of strong-fibered pulp. Up to now, attempts to dissolve the lignin complex in organic solvents haven't panned out commercially.

Recovery of the lignin complex as a valuable byproduct eliminates a serious pollution problem. Disposal of lignin is a big headache in sulphite pulp mills.

Weyerhaeuser Timber Co. has made experimental cooks with triethylene glycol at its Longview, Wash., mill, may build a pilot plant. Another company is using the process experimentally on shives (splinters of raw fiber not thoroughly reduced in cooking and bleaching) from its sulphate and sulphite pulping operations. Developed at the University of Washington by Prof. Bror L. Grondal and Piotr Zenczak, the process has been turned over to Research Corp. in New York for further pilot-planting and commercial development.

The process is relatively simple, consisting of the cooking of wood chips in a digester with triethylene glycol to which a small amount of aluminum chloride catalyst is added. With aluminum chloride, defibration has been satisfactorily accomplished at atmospheric pressure at a temperature not exceeding 250 deg. F.

Centrifuging separates pulp from the extract containing the lignin complex. Addition of water to the triethylene glycol extract precipitates the lignin complex. Both pulp and lignin are washed countercurrently with

water to recover solvent. After water is removed from it, the triethylene glycol is recycled to the digester.

Glycol recovery is the key to the economic success of the new process. Recovery of 95 percent of the triethylene glycol will be necessary for profitable operation. Triethylene glycol is more expensive than other pulping chemicals; but this extra cost, of perhaps $5 per ton of pulp, is offset in part by the value of the by-product lignin and the increase in pulp production.

The recovered lignin complex has promise as an adhesive and as a binder for hard board. It's also a tantalizing source of other chemicals. One reason why it's more valuable than the lignin obtained by other methods: this complex contains only traces of carbohydrates, hence there's no danger of a condensation occurring.

Higher yields of better quality pulp are expected with the glycol process. A pulp yield at least 5 percent higher than that obtained by conventional cooking processes is anticipated. The pulp is lighter in color than kraft pulp and easier to bleach. What's more, paper made from it promises to be stronger than kraft paper. Here's why: in the glycol process, hemicelluloses in the wood aren't hydrolyzed appreciably; instead, they remain to bind the fibers; this means stronger papers. For short-fibered woods, previously unsuited for papermaking, this is particularly important, but all woods normally pulped can be used in the process.

Off and on, attempts have been made in the past to use such organic solvents as alcohols, phenols, monoethanolamine, chloral hydrate and dioxane to dissolve the lignin complex during pulping. Reasons why they've failed include incomplete separation of the lignin, prolonged cooking cycle, degradation of the cellulose, poor quality pulp or too much chlorine in the extracted lignin complex.

Today, successful commercial pulping processes utilize water solutions of inorganic sulphur compounds to separate lignin from cellulose. These are comparatively cheap and produce good pulp. But the yield of pulp from wood is, by weight, only about 50 percent, and there's an appreciable loss of fiber strength. On top of that, the dissolved lignin complex and carbohydrates resulting from these processes provide a difficult waste disposal problem or require a costly recovery system. The University of Washington's glycol process eliminates the danger of pollution by recovering the lignin as a byproduct, while increasing the yield of strong pulp.

(Continued)

FOSTER FLOW TUBE*

(Gentile Patents)

Less Throat Constriction

Less Flow Restriction

Study the above picture of the Foster Type V Flow Tube which operates on the viscous drag principle. Note the almost straight-through construction. There's only a slight throat constriction. And the same minimum throat constriction is typical of the Type D Flow Tube which operates on the principle of dynamic impact. *Both types offer minimum resistance to flow.*

You know what this means. Negligible unrecovered head loss in the flow of the liquid or gas. Less power required to push it along.

"Good," you say, "but what about accuracy?"

The Foster Flow Tube will measure the flow of liquids or gases with an accuracy at least comparable to that of conventional primary devices and, in most cases, with considerably greater accuracy, because it can readily be installed in that section of the hydraulic system where flow conditions are uniform and steady. Thus, with this unique Flow Tube, you can combine accuracy with negligible head losses—accuracy with compactness—accuracy with ease of installation.

Write us in detail about your problem, giving both processing and installation requirements. We have several types and units in all commercial pipe sizes.

*A Proved Flow Tube Added to Foster Line of Regulating Valves

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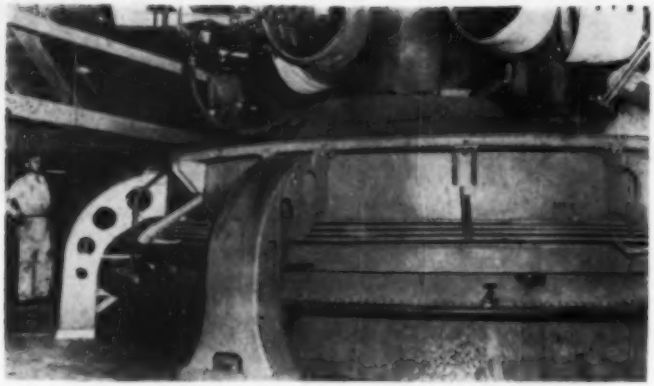
PRESSURE REGULATORS ... RELIEF AND BACK PRESSURE VALVES ... CUSHION CHECK VALVES ... ALTITUDE VALVES ... FAN ENGINE REGULATORS ... PUMP GOVERNORS ... TEMPERATURE REGULATORS ... FLOAT AND LEVER BALANCED VALVES ... NON-RETURN VALVES ... VACUUM REGULATORS OR BREAKERS ... STRAINERS ... DISCS ... SAFETY VALVES ... FLOW TUBES



ROOF of this phosphorus furnace doesn't rotate, rest of it does, but . . .

Why Use a Rotating Furnace?

Because—as TVA now proves—it'll cut electric energy needs and lengthen the life of the lining. TVA's unit is the first rotating phosphorus furnace in this country.

Tennessee Valley Authority's new phosphorus furnace—the first of its kind to use a rotating crucible—is now in regular production at Wilson Dam, Ala. The unit, rated at 7,500 kw., replaces an old stationary furnace. It was started up in October 1950, has been turning out phosphorus without special operating labor since early this year.

The new-type rotating unit is a basic change in the design of phosphorus furnaces. It is a change that may mean much to the future of the fast-expanding phosphorus industry of this country.

Demonstrated advantages of the rotating furnace are: (1) reduced electric energy requirements that may pan out to be 10-15 percent less than for old-design stationary units; (2) a longer life for the expensive furnace lining; (3) a smoother operation that comes from fewer cavities in the charge; (4) perhaps most important in the long run, the direct smelting of unagglomerated phosphate fines instead of the more expensive lump or sintered phosphate rock.

Balanced against these advantages is the fact that a rotating unit costs more—by a few percent—than a stationary one. The complete engineering economics aren't yet known, of course, for TVA engineers are still gathering data on various operating conditions and feeds.

Basic design of the new-type furnace hinges on rotating the crucible and its contents while keeping the roof and suspended electrodes stationary. This is done by using a seal of molten lead between the crucible and the roof. The lead is kept molten by submerged electric elements.

The furnace crucible (with an inside diameter of 16.5 ft.) is mounted on a turntable supported from a circular rail by rollers. A small motor and speed reducers rotate the crucible at a rate of one revolution in anywhere from 15 to 100 hr.

In the early months of operations, there was some trouble from breaking electrodes; this difficulty has now been eliminated. Operation is now at a speed of one revolution in 50 hr. At this speed and at 325 v. and 7,500 kw., power consumption is about 5.44 kwh. per pound of phosphorus produced.

Details on the design and performance of the TVA rotating furnace will be given in an article to be published soon in *Chemical Engineering*. It will include data on operating conditions and yields.

Rubber Unit Increases Output, Streamlines Process

Output of United States Rubber Co.'s synthetic rubber plant at Port Neches, Tex., will soon be boosted to 7,200 tons a month. Contract for engineering design work on the job has just been awarded.

Besides increasing capacity, U. S. Rubber will convert 50 percent of the entire Port Neches facilities to cold rubber production. Remainder of the facilities will continue to make standard 117-deg. F. GR-S rubber. The present batch operation system will be converted completely to a continuous set-up within a few months.

One of the plant's 30,000-ton units will be converted from batch-wise to continuous operation for producing cold rubber. The other unit—also rated at 30,000 long tons a year—will be converted to continuous output of 117-deg. F. synthetic rubber.

The entire project, which will probably cost more than $1,000,000, will boost synthetic rubber capacity at Port Neches to about 86,400 long tons a year—an increase of almost 45 percent.

CPI Gets $932 Million Fast Write-Offs During Month

There's no doubt about it now: the chemical process industries are getting the lion's share of fast tax write-off certificates issued by Defense Production Administration for new defense facilities.

During the past month (April 9-May 11) the chemical process industries received rapid write-off certificates to cover some $392 million worth of new productive facilities. This is close to 43 percent of the total for all facilities of all types certified by DPA during the same period.

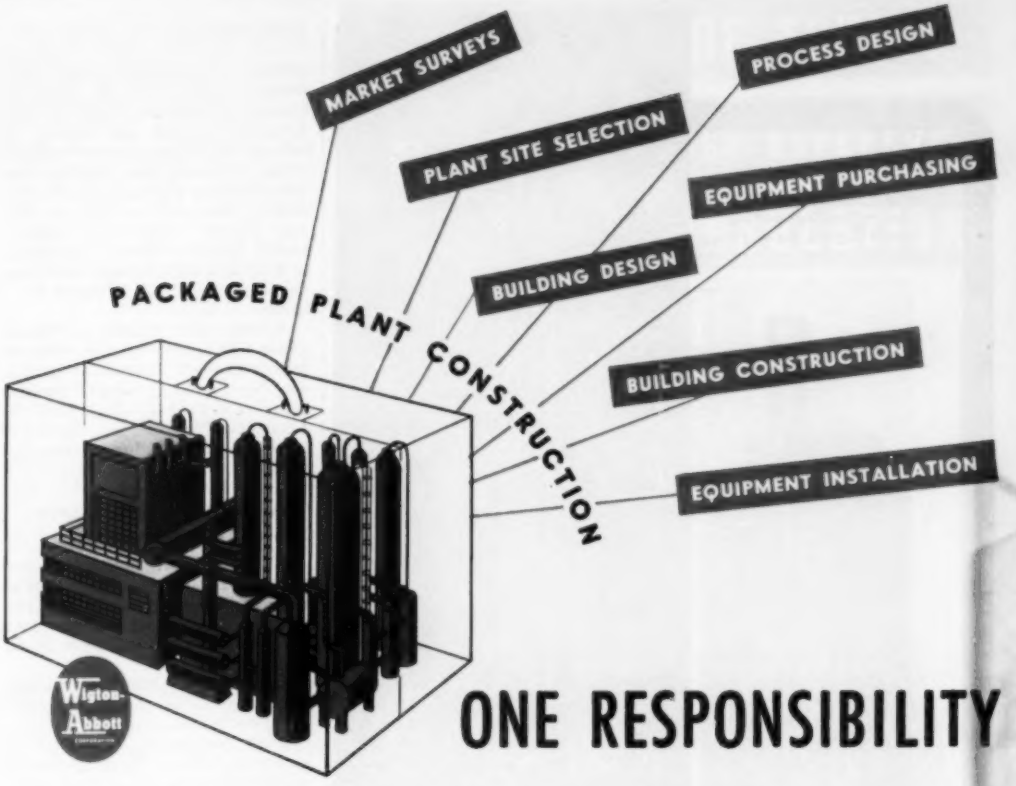
Top member of the process industries was the chemicals group; its certified facilities totaled up to some $129 million. Next came the pulp and paper industry with $108 million. Lowest was the fertilizer industry with only $70,000.

Here is the line-up of the chemical process industries with the approximate amount each was authorized for rapid write-off during April 9-May 11:

Chemicals	$129,000,000
Pulp & Paper	108,000,000
Petroleum products	59,000,000
Aluminum & titanium	55,000,000
Antibiotics	21,000,000
Glass	14,000,000
Ceramics & refractories	4,000,000

Largest item in the chemicals group was $54 million for alumina facilities at the Bauxite, Ark., plant of Aluminum Ore Co. Next was $10 million for benzene at Shell Oil's Deer Park, Tex., plant. Then came $9 million for Victor Chemical's phosphorus works at Silver Bow, Mont. General Chemical hooked close to $8 million for sulphuric acid at Newark, N. J., and Newell, Pa., while Bethlehem Steel got $4 million for sulphuric at Baltimore City, Md. Over $8 million went to Air Reduction for calcium carbide at Calvert City, Ky.

Other certificates covered facilities to make citric acid (Miles Labo-



ONE RESPONSIBILITY

Pass along the burden of details. When you entrust Wigton-Abbott Corporation with the entire project of new construction, expansion or remodeling your present plant facilities, you set in motion a smoothly functioning organization that assumes complete responsibility.

This single, important decision eliminates confused planning, costly "trial-and-error" waste, time-consuming negotiations, involved scheduling and heart-breaking disappointments.

"Packaged Plant Construction," a complete service from planning to production, is designed to put your proposed plant into full operation at top speed, with maximum economy. Wigton-Abbott Corporation's service includes 7 basic elements — market surveys, plant site selection, process design, building design, equipment purchasing, building construction and equipment installation. You may avail yourself of this service in its entirety or turn the job over to Wigton-Abbott Corporation at any stage for completion.

To perform and to coordinate these complex functions, Wigton-Abbott Corporation employs the experience and skill of engineers and architects—including specialists in all branches of chemical, mechanical, electrical, civil and industrial engineering. The Construction Department is staffed and equipped to erect any type of industrial plant.

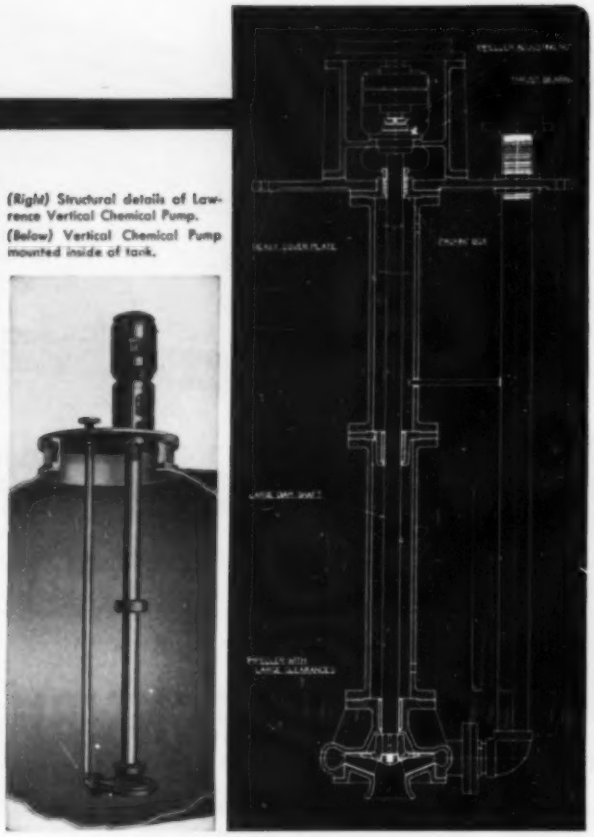
A Wigton-Abbott Corporation representative will be glad to consult with you on any phase of plant design and construction.

● *Yours for the asking*

"Packaged Plant Construction". Reading time, only 10 minutes — but it will save you many hours by answering basic questions.

Wigton-Abbott Corporation

DESIGNERS...ENGINEERS...CONTRACTORS...PLAINFIELD, NEW JERSEY



(Right) Structural details of Lawrence Vertical Chemical Pump.
(Below) Vertical Chemical Pump mounted inside of tank.

VERTICAL CHEMICAL PUMPS

Difficult chemical pumping problems—handling hot concentrated acids, corrosive alkalies, molten salts, molten sulphur, volatile semi-fluids, etc.—have been a LAWRENCE specialty for over 80 years.

To meet the demands of this rigorous service, LAWRENCE Vertical Chemical Pumps are made of metals or alloys carefully chosen to give the best protection against the corrosive and abrasive action of the liquid pumped, as well as structural strength and long wear. Other design features (depending on the circumstances) include liquid seals for high vacuum, the elimination of packing, mounting bearings above the level of the liquid pumped to prevent contact, and many more refinements that contribute vitally to efficient, trouble-free operation.

If you have a particularly difficult chemical pumping problem, write us the pertinent details.

LAWRENCE
MACHINE & PUMP CORPORATION
369 MARKET STREET, LAWRENCE, MASS.

ratories), citric and oxalic acids (Chas. Pfizer), allethrin (U. S. Industrial Chemicals), uranium oxide (Climax Uranium), bromine and ethylene dibromide (Dow), magnesium chloride (Dow), synthetic fluid cracking catalyst (American Cyanamid), maleic anhydride (Monsanto), caustic and chlorine (Arvey Corp. and Hooker), methyl chloride (Dow), trifluoracetic acid (Minnesota Mining), methylene chloride (Dow) and benzene by a number of firms.

Among the non-ferrous metals group, $14 million went to Titanium Metals Corp. of America at Henderson, Nev., for production of titanium metal. Du Pont got $1,227,000 for titanium at Newport, Del. Some $39 million went to primary aluminum producers.

Teamwork May Conserve Scarce Trichloroethylene

To conserve trichloroethylene, now scarce, users of the solvent for degreasing will ship contaminated trichloroethylene back to its manufacturers. They will reclaim the solvent by distillation.

Contaminated solvent often contains 60 to 70 percent of recoverable trichloroethylene.

Most degreasing equipment is equipped with a still for reclaiming trichloroethylene. But when machines are in constant use, time is not taken for distillation.

Instead of disposing of used solvent, companies will return it to the manufacturer so that a considerable saving in the over-all supply can be made.

Manufacturers of degreasing equipment have also volunteered to show users of their equipment how to operate it for maximum efficiency.

This cooperative conservation effort is being undertaken at the behest of the National Production Authority. If it works, it may not be necessary to allocate trichloroethylene.

Helium will once again be recovered by the Bureau of Mines at its $3.5 million World War II plants. Annual capacity: 48 million cu. ft.

Propellant charges for big guns will again be made at the Indiana Arsenal in Charlestown, Ind. Goodyear Tire & Rubber Co. will rehabilitate and operate the World War II plant.

New paint plant—believed to be one of the most modern in existence—has been opened at Torrance, Calif., by Pittsburgh Plate Glass Co. It features latest materials handling

equipment, one-story manufacturing structures. Cost: $1,250,000. Products: a complete line of house paints, varnishes, resins, industrial and automotive finishes.

Triple crude oil capacity: That's what Continental Oil Co. plans to do with the $23 million it will spend at its refinery near Lake Charles, La. Construction should be completed by the first of 1952. Louisiana granted ad valorem tax exemptions for five years.

Smokeless powder will again come from reactivated $125 million Badger Ordnance Works near Baraboo, Wis. Liberty Powder Co., subsidiary of Olin Industries, will operate it under a fixed fee contract.

Pilot plant to turn out 500,000 tons a year of taconite concentrates will be set up by Oliver Iron Mining Co. at Mountain Iron, Minn. It will begin operations by mid-1952 to produce high-grade iron concentrates from vast low-grade ore deposits. Key unit operations: disintegration, magnetic separation, agglomeration.

Chlorine capacity of Diamond Alkali Co.'s Houston, Tex., plant will be boosted to 400 tons a day by a $5.5 million expansion now under way. This includes the $2.3 million expansion announced in January. Eventually, Diamond may use the remainder of the $11,560,550 authorized by NPA, which would double present output at Houston.

Pennsalt's capacity on the West Coast will be increased by a $4 million expansion. At Portland, Ore., output of chlorine, caustic and chlorates will increase 48 percent this year; DDT output will jump 70 percent. Also at Portland, Pennsalt will start making alkaline cleaners. Production of chlorine and caustic at Tacoma will go up 30 percent.

AEC has picked National Lead Co. to become contract-operator of its $30 million Feed Material Production Center to go up near Cincinnati (*Chem. Eng.*, May 1951, p. 223). Catalytic Construction Co. designed the plant, which George A. Fuller Co. will build.

Fourth zirconium metal unit will soon be built at Albany, Ore., laboratory of Bureau of Mines. New building will cost $350,000. Process reduces zirconium tetrachloride with molten magnesium (*Chem. Eng.*, March 1951, p. 116). —*End*

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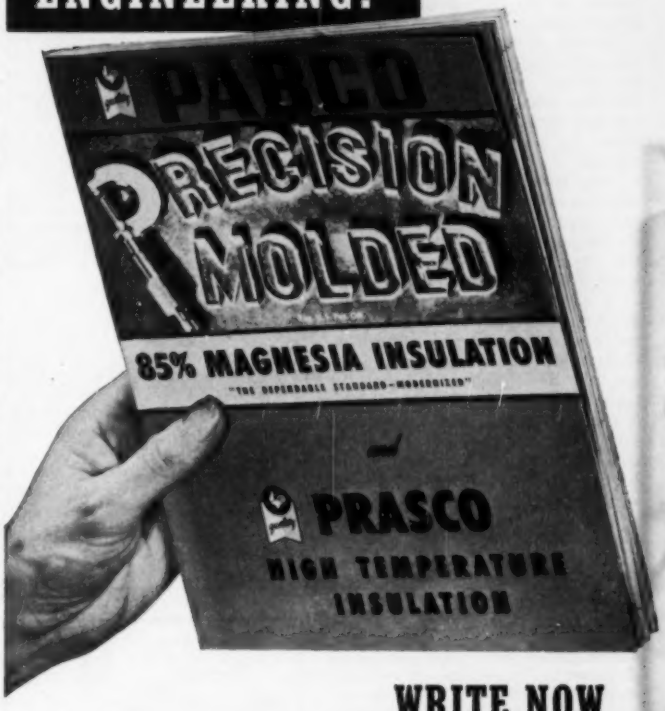

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Readers' Views & Comments

Underground Processing

Sir:

. . . I was very much interested in a process described in your April issue (p. 182) for establishing an underground gasification passage by electrocarbonization. I think this work . . . by the Sinclair Coal Co. and Missouri School of Mines is a valuable step forward in the underground gasification program.

It offers an opportunity to conduct the entire process without ever having an operator or miner underground. This not only removes the hazards of the underground operations, but will make the process much more economical.

The Bureau of Mines and the Alabama Power Co. are starting a new experiment at Gorgas, Ala., in which an attempt will be made to establish the underground passages for a distance of about 180 ft. by this method.

. . . we believe this experiment may show a considerably better quality of gas than has heretofore been obtained. Completion of this experiment will not only be valuable with respect to gas quality but in the determination of the amount of coal that can be consumed from an initial passage established by this method. We hope to have results from this test by the end of this year.

W. C. Schroeder
Chief
Synthetic Liquid Fuels Branch
U. S. Bureau of Mines
Washington 25, D. C.

Industry, too, is watching with keen interest the outcome of these tests on underground coal gasification. As one engineer recently put it: ". . . they may very well usher in a new era in coal processing that will have a marked influence on the nation's entire chemical economy."—Ed.

Ethylation Warning

Sir:

Your March issue, on p. 279, contains a commodity survey on ethyl cellulose. . . Under the sub-topic "How it is made," you state that "the steam-heated jacket raises the temperature above 190 deg. C."

This temperature, 190 deg. C., is above the critical point of ethyl chloride, which is given on p. 166 of Perry's *Chemical Engineers' Handbook*, Third Ed., as: tc °C = 187.2; Pc atm. = 52. This value of Pc is equal to 765 psig.

Your review of ethyl cellulose is obviously taken from *Chem. & Met.*, Sept. 1945, p. 129. On p. 131 of this article the test pressure of the autoclaves is given as 700 psig. and on p. 132 the operating temperature is given as *below* 400 deg. F. (149 deg. C.). The pressure of ethyl chloride at this temperature is 30 atm. or 440 psig. Thus, the vessels are tested at 1⅔ times the operating pressure.

Furthermore, an ethylation is mildly exothermic . . . and an ethylation temperature of 149 deg. C. would be very excessive.

A. B. Savage
Cellulose Products Division
Dow Chemical Co.
Midland, Mich.

We wish to point out—and with emphasis—that an ethylation above the critical point of ethyl chloride can be extremely dangerous and is to be avoided. Pressure vessels must also be properly designed, tested and operated.—Ed.

Multiply by 30

Sir:

I was . . . somewhat concerned when I read my latest article (p. 112, April) on utility conservation to note that the potential savings given at the top of the article are in error by a factor of 30—which stands for the days per month. Whoever did the editing multiplied the figures in the daily utility budget chart by 12, but forgot that there are 30 days in each of those 12 months.

This error . . . is unfortunate because the figures given now are "peanuts" and not worth setting up a conservation program to realize. But when the true figures are given, it lifts these savings out of the "peanuts" class and makes a utility conservation program very worthwhile.

Jackson D. Leonard
Consulant
245 Rose St.
Metuchen, N. J.

Jackson Leonard is one of our favorite authors (and, incidentally, he has several more articles in the "rough draft" stage). So we hasten to apologize to him—and to you—for forgetting that there are 30 days in a month! The utility conservation program he recommends is really worthwhile, as these correct figures on yearly savings at one plant show:

. . . $57,240 *for steam*
. . . 16,920 *for electricity*
. . . 6,480 *for water*

This total savings of $80,640 is not "peanuts."—Ed.

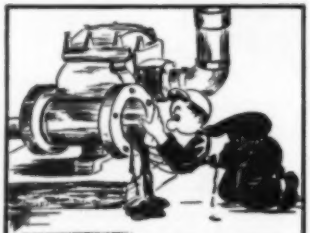
15,000 Word Answer

Sir:

I am a chemical engineer now operating a good-size chemical plant on the outskirts of Chicago. I graduated seven years ago from ———— Uni-

(Continued)

LITTLE BONERS



Tar Can Cause Trouble

"There's tar on the piston rod of the feedwater pump! There's oil on the surface of the water in the boiler gage-glass! What'll I do?" The fireman called frantically to the superintendent of the new plant.

"Try a blow-down—I'll be right over," the superintendent answered.

What the superintendent saw at the boilerhouse confirmed the fireman's report. To make matters worse, the blowdown valves were partly obstructed. Nothing to do but shut the boiler down and find out what was wrong.

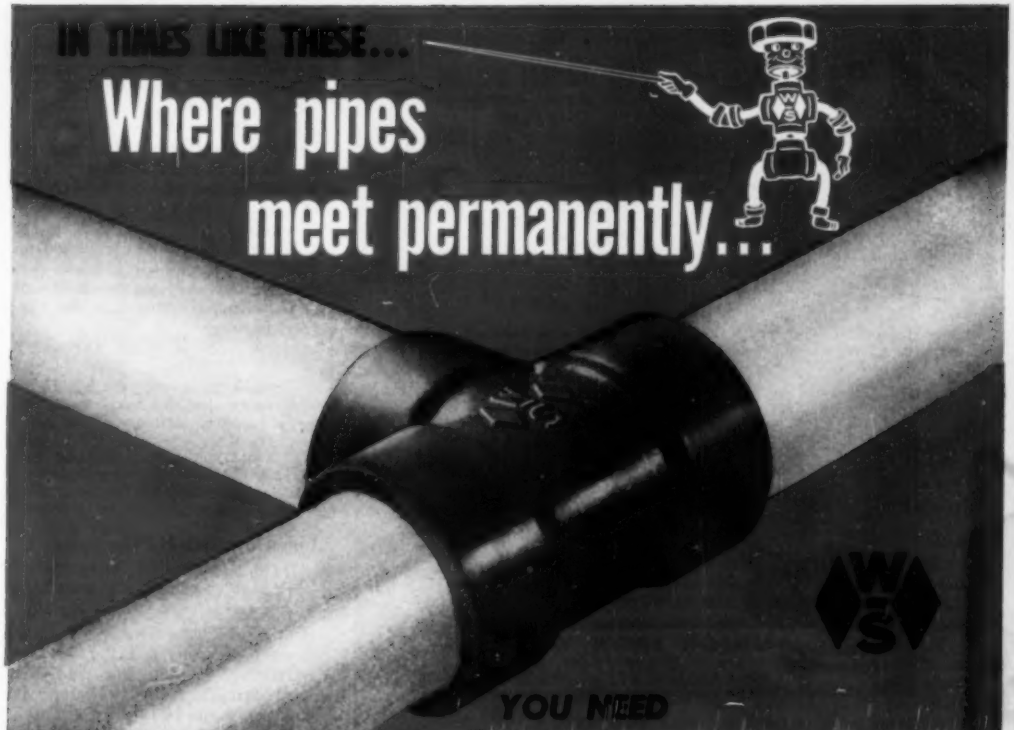
Then tar was found in the feedwater heater. That put the finger on the return condensate system. A follow-back along the condensate lines led to a steam-jacketed tar pump.

And there it was! The steam-fitter had mistaken the pump cylinder drain cocks for the condensate drain connection from the steam jacket. So he connected them to the return condensate system. When the tar pump was placed in operation the cylinder drain cock vibrated open; tar was then pumped into the boiler feedwater system through the return condensate lines.

Yes, it took a lot of work to get that boiler plant fixed up—including a clean-out of the feedwater heater, turbining the boiler tubes and removing coke from the boiler drums. Why not send in your favorite "little boner" to the Editor, *Chemical Engineering*, 330 W. 42nd St., New York 18, N. Y.

IN TIMES LIKE THESE...

Where pipes meet permanently...



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SCREWED FITTINGS . . . are designed with ample metal sections. The wall-thickness is faithfully observed in final manufacture. Extra long bands extend well beyond the last thread, providing reinforcement at points of severest strain. Threading — is long, accurately cut, and perfectly aligned to insure tight joints. All fittings are properly chamfered to protect thread and afford easy entrance of the pipe.

SOCKET-WELD FITTINGS . . . Just slip over end of pipe and weld. Deep sockets supports and aligns pipe, eliminates tack welding and the use of special fixtures. Accurate measuring and cutting of pipe unnecessary . . . Assure come and go. No welding icicles inside pipe — no clogged lines. Wall sections 1¼ times the nominal pipe thickness permit proper heat penetration and correctly proportioned fillet weld.

Basic materials are selected from a wide choice of carbon, stainless and alloy steels. Drop forging and precision machining makes them light in weight, assures accuracy of finish, and all are instrument inspected for perfection of threads, sockets, angles and concentricity. Write for Bulletin AS-50. For information on Stainless and Alloy Steel Fittings, Bulletin S-1.

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versity, where I got an excellent training in chemical engineering but precious little practical help on the "whys" and "hows" of electrical equipment.

Now I find that my plant manager expects me to know all about electric motors and just why one type should be used . . . for a special job instead of another.

Can you refer me to published information, or perhaps a book, that deals with motors from the standpoint of the chemical rather than the electrical engineer . . .?

NAME WITHHELD

We can't always give readers a 15,000 word answer, but this time we can: our special report for next month will be on motors and motors control. It'll be especially slanted for chemical engineers, such as Reader T———, in chemical plant design and operations.—ED.

Concentrating H_3PO_4

Sir:

The story on page 193 of your April issue which described the phosphoric acid concentrator of Gates Brothers at Wendell, Idaho, was very interesting. Despite the fact that most "firsts" in the field of submerged combustion can be credited to Ozark-Mahoning Co., we are still very jealous of our accomplishments and would like to set the record straight regarding phosphoric acid concentration by submerged combustion.

Ozark-Mahoning Co., supplied two submerged combustion phosphoric acid concentrators to the Southern Acid & Sulphur Co., Pasadena, Tex., (now Mathieson Chemical Co.). Each of these units had a rated heat output of 5,040,000 Btu. per hr. These concentrators were put into service in July, 1945, and were concentrating phosphoric acid from 32 percent P_2O_5 up to 45 percent P_2O_5. We understand they have concentrated up to 50-55 percent P_2O_5. To the best of our knowledge these units are presently operating for Mathieson Chemical.

A third submerged combustion phosphoric acid concentrator was supplied by Ozark-Mahoning in 1949 to Gulf Chemical Co. at Galena Park, Houston. It was of the same capacity as those supplied to Southern Acid & Sulphur. This unit was initially used for heating finely ground phosphate rock in the presence of phosphoric acid of 70 to 75 percent H_3PO_4. We understand that at present it is being used to concentrate phosphoric acid in the range of 30 to 40 percent P_2O_5.

. . . generally accepted definition of submerged combustion is "burning of

a fuel beneath the surface of a body of liquid." We think that most authorities would agree with us that any equipment in which the combustion does not take place beneath the surface of the body of fluid, should not be called submerged combustion.

WM. I. WEISMAN
Ozark-Mahoning Co.
Tulsa 1, Okla.

We're glad to pass along Reader Weisman's interesting information on the development and use of Ozark-Mahoning submerged combustion concentrators in the phosphoric acid industry.—ED.

Glass Shatters Record

Sir:

. . . so far as I can recall, your April report on glass is the first time there has been such a report confined to glass in all its forms for industrial purposes. I think Mr. Smith has done an especially good job in combining the information received from such a wide variety of sources.

I believe the article should be especially useful to people who . . . select materials of construction.

Several of our people have read the report . . . all the comments I have heard have been very favorable.

S. W. MCCANN
Assistant Factory Mgr.
The Pfaudler Co.
1000 West Ave.
Rochester 3, N. Y.

If you, with Mr. McCann, liked our Glass Report in April, you're in good company. Comments from other subscribers, results of our readership surveys and requests for reprints all indicate that this report is one of the most popular features we've run in some time.—ED.

Feminiphobia?

Sir:

Where is this shortage of chemical engineers you've been talking about so much?

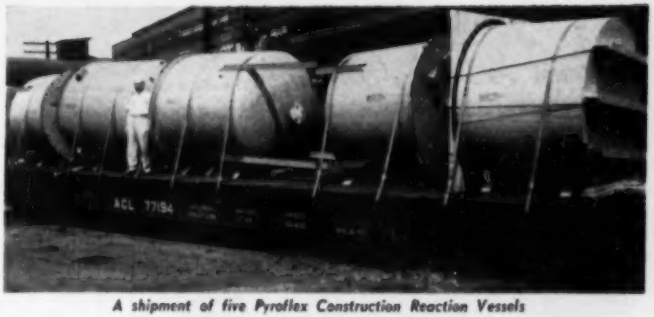
Does such a thing really exist? If it did I would now be making my contribution to our industrial mobilization effort.

There is no real shortage of engineers and there will not be any just as long as employers refuse chemical engineers who put on their applications "sex: female."

NAME WITHHELD

We have nothing to say to this. Do you?—ED.

We welcome pertinent letters from our readers. Address: The Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.



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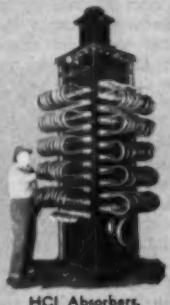
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When corrosion proof equipment is needed give first call to Maurice A. Knight.

Each Pyroflex-Constructed Tank, tower, fume washer, absorber, etc., is individually designed to meet the requirements of the situation in which it will be used. In these complete engineered functional units Knight engineers incorporate the materials best suited to the individual service conditions. Materials may include ceramics, glass, fused silica, plastic, carbon or any other suitable material. Knight engineers have had wide experience in the proper selection as well as the application of corrosion proof materials. Consequently, these Knight engineered units offer longer trouble-free service with less down time and lower maintenance cost.

Knight also offers a light weight laminated plastic under the trade name of Permanite. It is corrosion resistant throughout and is used in the fabrication of complete functional units, such as fume washers, HCl absorbers, etc. Permanite is also available in light weight pipe and duct work.

When making inquiry please specify the type of equipment in which you are interested as well as service conditions involved. Literature, Pyroflex Construction 2-B and Permanite 6-B, will be sent on request.

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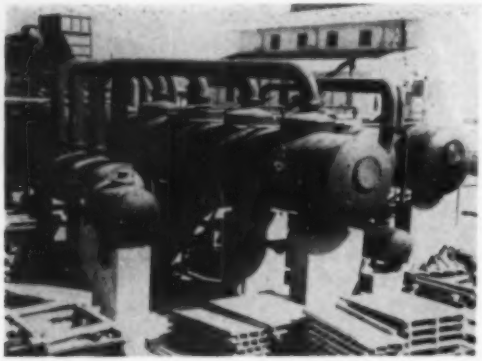

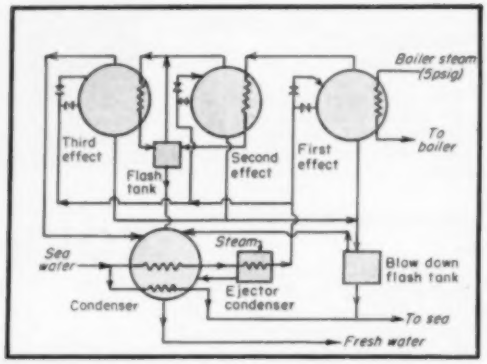

Triple effect evaporator. Kuwait Oil Co. makes 720,000 gal. of fresh water daily from sea water with six of these units.

Evaporators Solve Refinery's Water Problem

Adaptable new distillation system—a money saver in the U.S., a life saver for refinery in arid Kuwait.

An American firm located on a river that becomes brackish during periods of low stream has installed a novel distillation plant to maintain a minimum quality in the water for its manufacturing process. For the Kuwait Oil Co., intent on developing the rich oil resources of an Arab Sheikdom on the north Persian Gulf, the same type of installation is filling a far more pivotal spot. An area where only oil comes up when you drill for water is an undeniably logical site for a large refinery. Except—how do you supply your personnel with enough drinking water (thousands of gallons a day) to keep them alive? The costly stop-gap answer was to import water by ship. With the aid of Westinghouse's triple effect evaporator system, the salty Persian Gulf was forced to provide the final solution.

Natural Gas Heat—Engineers got one more assist from the region's natural resources—plentiful, cheap natural gas. This gas is burned to supply steam for the distillation plant. Three evaporators (horizontal submerged-tube type) and one condenser comprise a unit. By performing the evaporation in three steps instead of the normal one, using the heat in the vapor of one as the energy source for the next, and by employing other Btu.—conserving tricks, more than 2½ lb. of fresh water are obtained for each pound of steam. With the single-step distillation process the output is not over one pound of water per pound of steam. The six units of the Kuwait Oil Co. provide 720,000 gal. of fresh water daily.

Triple Effect—The heating steam for each of the six first effects is supplied by the main steam boiler plant and is received in the evaporator unit as desuperheated steam at 5 psig. This steam is then returned to the boiler as water at 227.2 deg. F. Vapor from the first effect provides heat for evaporation in each second effect, and the second effect does likewise for each third. The condensed heating steam from the second and third effect is collected in a flash tank and vapor from the flash tank is led back into the system as heating vapor to the third effect. The condensate in the flash tank is drained to the main condenser. The incoming sea water feed is first pre-heated in the main condenser and then used as circulating water in the ejector condenser before being passed into each of the effects as feed water.

Each effect has a circular copper-bearing steel shell, ¼ in. thick and 6 ft. in diameter. Copper-bearing steel was used in place of normal mild steel to minimize the rate of corrosion. The first and second effects are 30 ft. long and accommodate 2,150 sq. ft. of heating surface consisting of 70-30 copper-nickel tubes with an outside diameter of 1 in. These are arranged in two bundles which drain to the center. The third effect is 38½ ft. long; to offset the lower heat-transfer coefficient, the heating surface has been increased to 2,200 sq. ft., again housed in two bundles.

Flash tanks are used to full advantage. Condensed steam from the second effect-coil is flashed and the vapor is admitted to the third-effect steam coil. Blow-down from all effects is flashed and the vapor introduced into the condenser. The condenser is capable of reducing the dissolved oxygen content of the distillate to less than 0.03 cc. per liter. This is important, as the make-up water to the power-plant boilers is taken direct from the discharge of condensers and introduced into the boiler feed system without further deaeration.

Descaling—The concentration of the sea water in the Persian Gulf is above normal. To avoid carry-over trouble and scaling up, the evaporators are operated with 50 percent of feed as blow-down. In addition a spray cracking device is incorporated in each effect. Descaling is achieved by draining the evaporator body and admitting the steam to the heating coils. Feed water is then admitted through sprays on to the hot coils to quench them quickly and crack off the scale. To permit this operation being carried out daily, the plant was designed to give the required daily output in 22 hr. Also, provision has been made for the complete removal of the coils and immersing in a bath of inhibited hydrochloric acid.

(*Continued*)

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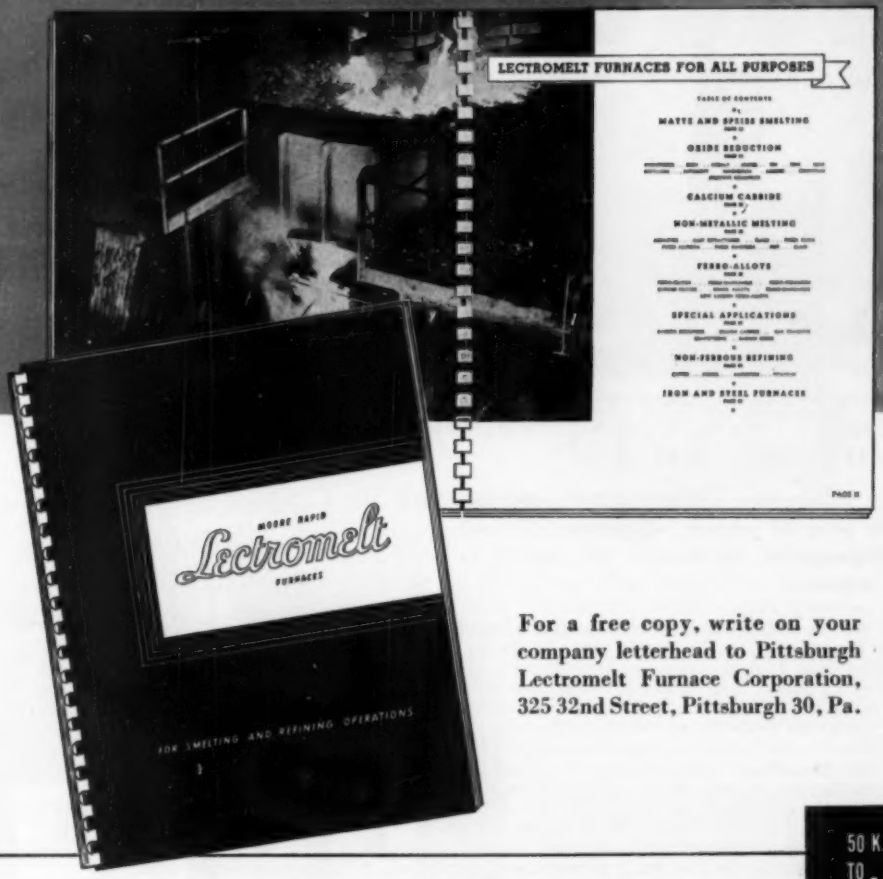
you need this new book



For a free copy, write on your company letterhead to Pittsburgh Lectromelt Furnace Corporation, 325 32nd Street, Pittsburgh 30, Pa.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

To prevent carry-over troubles, the outlets from each effect are fitted with a centrifugal separator. These are so designed that small droplets of water present in the steam are thrown to the outside of the apparatus and fall back into the main liquid. A four point conductivity meter is incorporated with each evaporator which, in addition to indicating the quality of the distillate, is also connected to the ejector drains and to the drains from the second and third effect evaporators so a leaky tube or carry-over from any effect can be readily traced.

AUSTRIA

New tar distillery under construction for the United Austria Iron and Steel Works in Linz will have a capacity of 40,000 tons. In addition to road tar, benzene, toluene and xylene, naphthalene, phenols, impregnating oils and other products will be made. Most of the equipment is being supplied by Germany. Operation will begin by the end of the year.

Ammonium sulphate from gypsum and ammonia will be produced on a large scale at the Austrian Nitrogen Works in Linz. This is in addition to 360,000 tons of lime ammonium nitrate annually. Sulphuric acid is also to be obtained from gypsum by a German process. Part of the acid will go to the rayon works at Lenzing and part will be used by the Nitrogen Works itself for production of phosphatic fertilizers.

Polyvinyl chloride plant under construction at Hallein will be completed by next year. Owned largely by Austrian interests, it will use local raw materials, will supply all the country's requirements for the product. (*Continued*)

Furfural extraction plant with steam and extraction towers.

Propane deasphalting plant in the foreground.

Lubricants for Italy

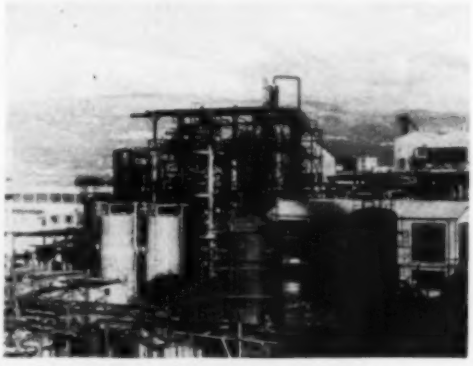
Four-plant refinery in Trieste can supply over 50 percent of peninsula's need for high-quality lubricants; 80 percent is now imported.

Just opened by L'Aquila Co. in Trieste is the largest refinery for high quality lubricants in Italy. Its claim to fame is two-fold. First, the volume of its production—over 25,000 tons a year—is equal to half of Italian demand for oils of that quality. Furthermore, it is the first plant opened in Europe to use crude oils of the Middle East for the production of select lubricants (largely bright-stock).

The works consists of four plants: one for furfural distilling; another for removing asphalt by the use of propane; another for deparaffination and de-oleation with methyl ethyl ketone; and a fourth which will allow production of oils of high viscosity (95 percent) characterized also by a high degree of stability and resistance to oxidation.

Oily paraffins obtained from the deparaffination of the refined oils will be processed for recrystallization in the same plant. Large quantities of crystalline and microcrystalline paraffines will be produced.

There are facilities for the blending of base oils which will assure the continuity of the types and their homogeneous quality. This equipment is of special importance in the preparation of premium oils for internal combustion engines and of the heavy-duty oils for diesel engines, both of which the company plans to make.



MEK dewaxing plant, foreground; clay contact plant, rear.

Crude for the refinery comes through the new trans-Arabian pipeline from the oil fields near the Persian Gulf to the Port of Sidon. The pipeline, which bypasses the Suez Canal, will be of great benefit to all of Europe and especially to Trieste. The city is considered the natural port for handling the crude oils of the Middle East.

ERP put up $4.25 million of the refinery's construction cost and the Trieste company invested a like amount.

NOT A COATING . . .

NOT AN ENAMEL . . .

NOT A GLAZE . . .

Solid Porcelain

NON-POROUS THROUGH-AND-THROUGH

The dependability and long life of the Lapp Valve is due to its sound design, and to the fact that it is made of *porcelain* . . . body, plug and packing rings. Not a coating or enamel, porcelain is a dense, homogeneous, thoroughly-vitrified ceramic, *non-porous*, through-and-through acid resisting. Not even is the corrosion-resistance of this material due to a glaze. In fact the "working parts" have no glaze. The smooth operation and pressure-tight seal characteristic of Lapp Valves result from precision-tolerance machining . . . grinding and lapping of solid porcelain to a mirror-like smoothness.

Valves and other equipment of Lapp Chemical Porcelain may be the answer to your corrosion problems. Write for literature. Lapp Insulator Company, Inc., Process Equipment Division, 405 Maple St., LeRoy, N.Y.

Lapp

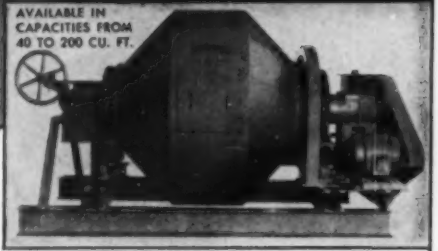
PROCESS EQUIPMENT

CHEMICAL PORCELAIN VALVES • PIPE • RASCHIG RINGS

PULSAFEEDER CHEMICAL PROPORTIONING PUMPS

UNEQUALLED *for Mixing Dry Ingredients*

The MUNSON Rotary BATCH MIXER



• The Munson Rotary Batch Mixer is unequalled for mixing or blending dry ingredients. It's the work-horse in many modern chemical plants where thorough blending and mixing, plus economy of operation and maintenance, are requirements of major importance.

• Design of this Mixer is flexible, to meet varied requirements. Built for either overhead, working floor or basement installation, Munson Rotary Batch Mixers range in capacity from 40 to 200 cu. ft. Total capacity depends upon desired size of batch and weight per cu. ft. of ingredients.

• In addition to general chemical applications, these Mixers are widely used in mixing fertilizers, gelatins, glue, disintegrated metals, paint ingredients, plastic compounds, soap and cleaning compounds, and a wide variety of stock feeds and tonics.

• A Munson representative will assist you in selecting the proper Mixer for your requirements. Write for full information to "Dept. M".

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ACCURATE BLENDING
SPEEDY MIXING
RAPID INTAKE
RAPID DISCHARGE
LOW HORSEPOWER
LOW OPERATING COST

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MACHINERY BUILDERS SINCE 1885

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FOREIGN NEWS, cont. . .

CANADA

Huge aluminum development is about to begin in British Columbia. The first stage will take about three years to complete and the cost may exceed $200 million. Annual production is estimated at 330 million pounds of primary metal. Cost of the over-all project may come to $550 million.

FRANCE

Organic chemicals from petroleum will be manufactured for the first time in France at a plant being built by Societe Naphtachimie, near Martigues. Annual output will be 3,000 tons of ethylene oxide; 25 percent cut in production costs will result from use of a direct oxidation unit. Marshall Plan funds, $1.7 million, are backing the project.

July 1952 is the date on which the plant is scheduled for operation. From then on it will fulfill French requirements in chemical products which in 1950 were imported from the U. S. and Germany to the tune of $1 million.

GREAT BRITAIN

Efforts to conserve sulphuric acid have resulted in an ICI pilot plant at Billingham-on-Tees for the production of fertilizers by using nitric acid for the extraction of phosphate from Morocco rock. Extensive field trials are now being carried out before beginning manufacture on a commercial scale. The process has been under development for 20 years.

The government's Chemical Research Laboratory has come up with a successful method for producing superphosphate fertilizer by treating rock phosphate with a mixture of four parts nitric acid to three parts sulphuric. It is also at work on a process for producing fertilizers without acid—by high temperature fusion. If the process ever reaches the industrial scale, it will have a double-barreled advantage. Not only will it cut down the drain on short supplies of sulphuric, but it will furnish a market for an over abundance of serpentine, olivine and talc available in the Highlands of Scotland.

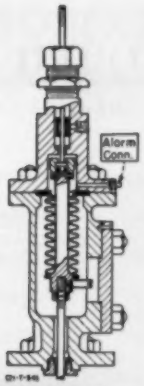
New sulphuric acid regeneration process is about to be installed on a large scale experimental basis at the South Wales tinplate mill of the Steel Co. of Wales. It promises to cut by 75 percent the 50-70 thousand tons a year of acid which the tinplate in-

(Continued)

COMPARE

THIS FEATURE

OF THE HONEYWELL SERIES "700" VALVE



BELLOWS SEAL

Packless Bellows Seal provides protection against fluid leakage or air infiltration. Special construction eliminates buckle or twist, assures positive seal between its housing and bonnet. Tap, in housing, permits alarm connection. Unit is easily replaced in field. Available in Monel for pressures up to 300 lbs. or in stainless steel to 600 lbs. In addition, conventional stuffing box affords added safety.

Specially Designed Neoprene Diaphragm

Duplex Upper Stem Guide

Safety Stem Lubricator

One-Piece Bonnet

Wide Variety of Discs

Reversibility in the Field

* Compare the Bellows Seal of this valve with that of any other wide band proportional type. Look at it closely . . . study it feature by feature.

Then check the other features of the valve . . . the Specially Designed Diaphragm, the Duplex Stem Guide, the One-Piece Bonnet, the Safety Stem Lubricator, the wide variety of discs, the easy reversibility in the field.

Your comparison will prove that the Honeywell Series 700 has *all* the features you look for in a fine valve.

It's available in a wide range of styles and sizes. For detailed information, write for a copy of Bulletin 700-2, or call in your local Honeywell engineer . . . he is as near as your phone.

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MINNEAPOLIS **Honeywell**

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PHOSPHORUS OXYCHLORIDE	PHOSPHORIC ACID
PHOSPHORUS TRICHLORIDE	SODIUM CHLORATE
PHOSPHORUS PENTACHLORIDE	POTASSIUM CHLORATE
PHOSPHORUS PENTASULFIDE	POTASSIUM PERCHLORATE
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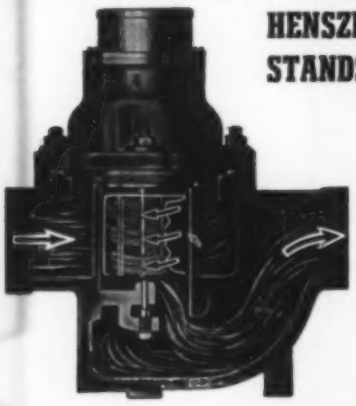

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The cutting, abrasive action of hot, dirty Boiler Blowdown quickly breaks down meters that depend upon close clearances and intricate parts for their accuracy. Henszey Meters stay accurate —stay on the job—accurately measuring Boiler Blowdown, Feed Water Condensate, FREE-RUNNING CHEMICALS and other "hard-to-measure" liquids. For details consult Sweet's Catalog or write:

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dustry uses for de-scaling steel in the strip mill process. That process leaves a large residue of ferrosulphate solution, formerly thrown away. Now the solution is mixed with coke and flash roasted. The oxides of sulphur produced are absorbed directly in water and oxidized catalytically giving a sulphuric acid which can be used for pickling without further dilution. Sulphuric produced by this method costs slightly less than "new" acid.

GERMANY

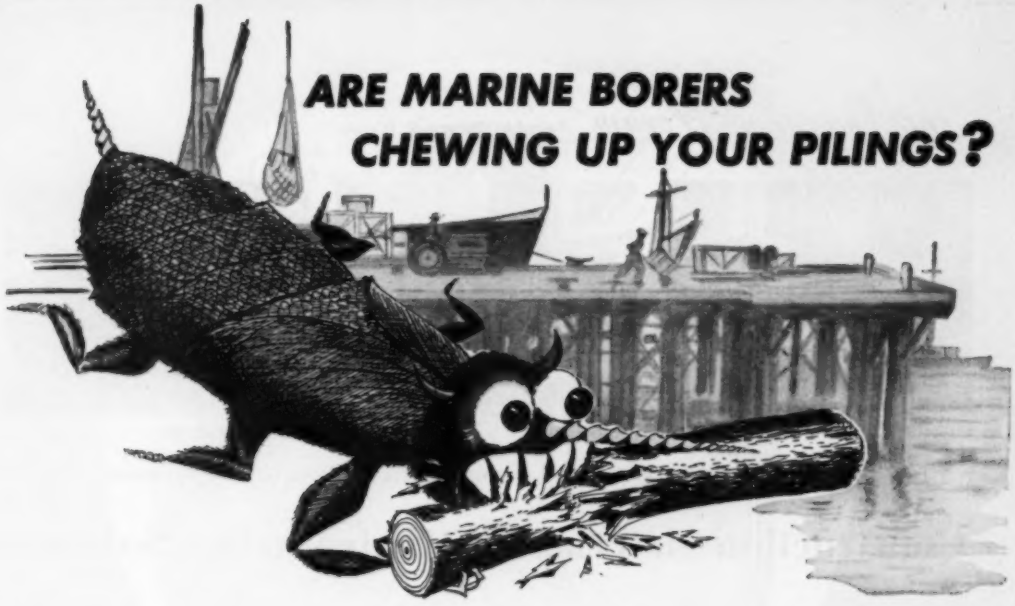
Synthetic rubber industry in West Germany hopes to be producing 20,000 tons of buna a year by the end of 1952. The industry was recently freed from an Allied ban on the manufacture of buna. However, still blocking off the goal are: war damage, effects of dismantling and the shortage of capital and coal.

The industry is not expecting any large in-flow of capital as the government has declared that the basic industries must come first. The production of 20,000 tons of buna a year would require about 200,000 tons of coal and this is not expected to be available very soon according to the German coal sales organization in Essen. Buna production can at present be resumed only at the chemical works in Huels (Ruhr). The plant at Ludwigshafen in the French zone was so badly destroyed it will take an estimated two to three years to get it going again. The Bayer works in Leverkusen (Ruhr) will specialize in perbunan, an oil resisting rubber.

NETHERLANDS

New superphosphate plant will make sulphuric from hydrogen sulphide. A 200-ton a day triple phosphate plant is being erected at Pernis near Rotterdam by the Albatross Superphosphate Co., Utrecht. A second phosphoric acid plant with a capacity of about 50 tons a day of equivalent phosphorus pentoxide is also being built. It will operate on the continuous wet process.

Although production is based on pyrites the company has already felt the effect of the world shortage of sulphur. Consequently it is building a sulphuric acid plant operating on the wet contact system which will use hydrogen sulphide from the nearby Shell refinery. Production will be about 15,000 ton a year of 78 percent acid. All plants are scheduled to begin operations in June. —*End*



ARE MARINE BORERS CHEWING UP YOUR PILINGS?

Starve them with steel—plus NATIONAL graphite ground anodes!

TRADE-MARK

WHY GRAPHITE ANODES ARE BEST FOR CATHODIC PROTECTION:

- **Complete and sure protection in sea water—indefinitely**
- **Positive control in any weather; just change a tap on the rectifier to raise or lower current input**
- **Perfect for use in high resistance soils**
- **Longest life of any anode material obtainable**
- **Thoroughly tested and proved in service for more than 20 years**

If your dock facilities are subject to attack by marine borers, install borer-proof steel pilings, and protect those pilings from underwater corrosion by economical long-lasting "National" graphite ground anodes.

The anodes are lowered to the bottom and connected with a shore-based rectifier. Another wire from the rectifier runs to the steel pilings. When current is passed, it flows out from the pilings into the water—thus giving very complete cathodic protection. No matter how severe the corrosive conditions are, you can regulate the current to afford the proper protection, simply by adjusting the rectifier.

Other advantages of steel pilings are: more strength ... better fire resistance ... less maintenance ... lower insurance rates.

"National" graphite ground anodes also provide the most practical and economical cathodic protection for *buried pipe lines, tank farms, oil well casings, water mains, underground cables, ship hulls* and dozens of other products buried in earth or submerged in water.

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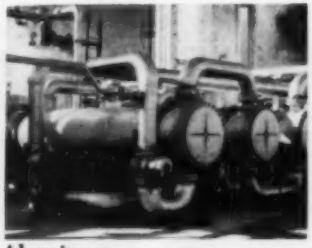
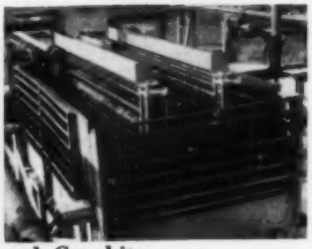
Durimet . . .



Aluminum . . .



and Graphite . . .

. . . stand up well in certain applications involving aliphatic and aromatic solvents.

Construction Materials vs. Hydrocarbon Solvents

Durimet 20

WALTER A. LUCE, *The Duriron Co., Dayton, Ohio.*

Durimet 20 exhibits a very high degree of corrosion resistance to the various solvents. It can be recommended as chemical equipment for handling these chemicals in the pure state or in combination with other chemicals for which it is suitable. Numerous other metals and alloys are also suitably resistant to these solvents, but nevertheless, Durimet is currently being applied as pumps and valves. The above photograph illustrates the use of Durimet 20 in solvent handling.

There is a tendency for certain of the solvents which contain chloride ions to hydrolyze in the presence of water to form hydrochloric acid. Durimet 20 has acceptable resistance to most of these conditions at normal temperatures and is superior to the conventional 18-8-S stainless steels and most other alloys in this respect. However, care is necessary when elevated temperatures are encountered since the attack on Durimet increases rapidly. Tests conducted on a water-carbon tetrachloride mixture at a very high temperature showed that the Durimet 20 alloy is excessively corroded.

Aluminum

W. P. COLMAN and W. W. BINGER, *Aluminum Co. of America, New Kensington, Pa.*

Aluminum alloys are virtually unaffected by most hydrocarbons encountered in the petroleum refining industry. Heat exchangers, stills, and piping of aluminum alloys are finding ever-widening application in this industry, as well as in the chemical and petrochemical fields. These alloys do not cause breakdown or sludging of refined hydrocarbons, and they are resistant to the action of sulphur-bearing gases and carbon dioxide, which are often present as contaminants in crude hydrocarbons. The lean-oil, rich-oil heat exchangers shown above have aluminum tubes.

Tables I and II are a partial listing of aluminum applications in the chemical, petroleum, and petrochemical industries wherein aluminum is exposed to various hydrocarbons and their derivatives. This list illustrates the versatility of aluminum alloys for handling this class of products. While laboratory investigations have in many cases been limited to the refined product, service experience has frequently shown that the crude material may also be handled providing steps are taken to neutralize any entrained mineral acids or alkaline earth hydroxides which may be present as contaminants.

Table I—Applications of Aluminum in the Petroleum Industry (Heat Exchangers and Heat Exchanger Tubes).

Condensing of hydrocarbon fractions as gasoline, naphtha, gas oil, etc.
Vapor recovery condensers
Lube oil coolers
Natural gas compressor after-coolers
TCC overhead condensers
Recompressor after-coolers
Hydrogen sulphide gas coolers.
Furfural condensers and exchangers
MEK service
Propane chilling
Wax sweaters
Depropanizer overhead condensers
Lean oil to fat oil exchangers
Gasoline to gasoline exchangers
Cat cracker overhead condensers

Table II—Applications of Aluminum in the Chemical and Petrochemical Industries.

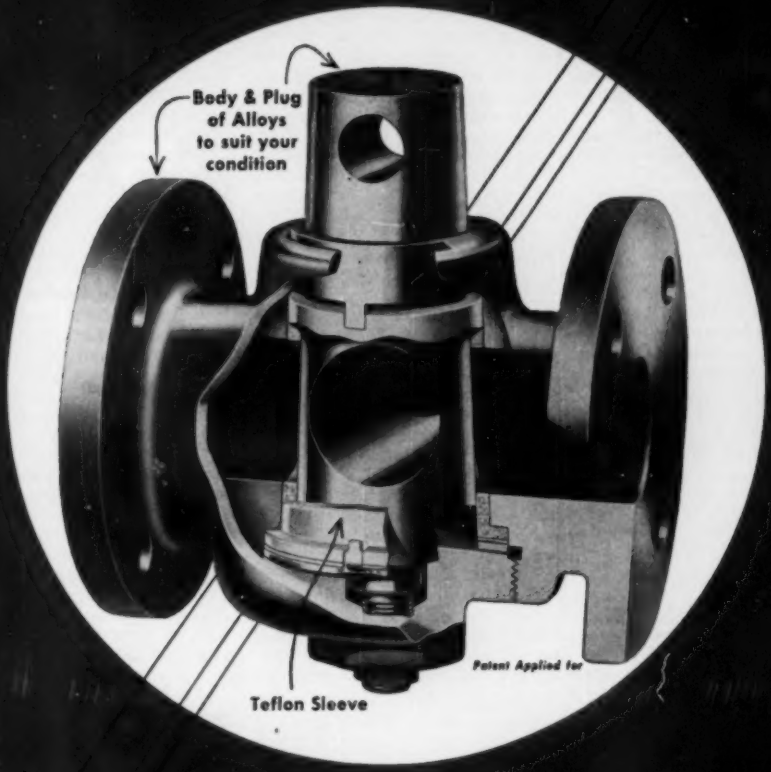
Acetaldehyde storage tanks
Acetic acid tanks, condensers, tank cars, shipping containers
Acetic anhydride tanks, tank cars
Acetone stills, heat exchangers
Aerosol propellant tanks, bombs
Alcohol (methyl, ethyl, propyl, and higher) condensers, tanks
Benzaldehyde tanks
Benzyl alcohol tanks
Benzene stills, fractionators, dephlegmators, condensers, tanks
Butyric acid and anhydride storage tanks
Creosote tanks
Essential oils, edible oils, vegetable oils; deodorizers, tanks, condensers
Ethyl benzene condensers
Fatty acids (oleic, palmitic, stearic, etc.); condensers, tanks, tank cars
Formaldehyde stills, condensers, tanks, tank cars
Furfural condensers, stills, tanks
Gases as butane, propane, etc.; piping, tubing
Glycerine stills, condensers, tanks, tank cars
Glycols (ethylene, propylene); stills, evaporators, heat exchangers
Hexane heat exchangers
Mineral spirits; tanks, piping, heat exchangers
Naphtha solvent; stills, fractionators, dephlegmators, condensers, tanks
Naval stores (rosins); turpentine stills, condensers, tanks, piping
Nitroparaffins (crude and refined); tanks
Tar and tar products; tanks
Thinners (paints); tanks
Toluene tanks, condensers
Waxes (petroleum, tar); condensers

Carbon and Graphite

W. W. PALMQUIST, *National Carbon Co., Cleveland, Ohio.*

Graphite and impervious carbon and graphite possess exceptional resistance to the corrosive action of both aliphatic and aromatic hydrocarbons. Under typical reducing conditions, carbon and graphite withstand temperatures up to the volatilization temperature of 3,600 deg. C. (approximate). In air, the threshold oxidation

(*Continued*)



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temperature is 400 deg. C. for graphite, 350 deg. C. for carbon. Impervious carbon and graphite are applicable to a material body temperature of 170 deg. C.

In handling of hydrocarbons, these materials are used chiefly where metallic contamination must be avoided or where the presence of other corrosives dictates their selection. Chlorination reactions, where the chlorinated product and hydrogen chloride greatly increase the system's corrosiveness, are typical. Carbon and graphite chlorination equipment includes heat exchangers such as the cascade type chlorinator reflux condensers shown in the photograph; fractionating towers for separation and purification of benzyl chloride, benzal chloride, benzotrichloride and benzoyl chloride; and conveying equipment—pumps, piping and ejectors. System temperatures reach a maximum of 180 deg. C.

Coatings

KENNETH TATOR, *Kenneth Tator Associates, Coraopolis, Pa.*

Hydrocarbon solvents, either aliphatic or aromatic, present in themselves no corrosion attack on the commonly used structural metals. Considerable difficulty has been experienced in storage and transmission, however, due to highly aerated moisture from the air condensing into the solvents and attacking the metal at the bottom of the tanks or piping, to form tubercules and pits. This type of deterioration can be effectively retarded or eliminated by coating such interiors with thin film coatings of hydrocarbon resistant organics. Where inhibitors are used to prevent such attack the amount of inhibitors required can be materially reduced by coating protection even though such coatings may be applied by inexperienced field crews and consequently have a high degree of film discontinuities.

As deterioration of any organic barrier by hydrocarbons is solely by solution or solvation the more polar organics should be expected to be resistant, and the non-polar materials should be avoided. Thus we find that the nonpolar bitumins, natural rubber, GR-S, butyl rubber, Vistanex, and polyethylene are unsuitable, either being dissolved or swollen to a useless degree. On the other hand we find that highly polar materials such as polyvinyl alcohol, the lower cellulose ethers, casein, and animal glues are entirely inert, but due to their highly polar nature are water-susceptible and, therefore, of no practical value. In order to secure both water and hydrocarbon resistance, materials of intermediate polarity must be selected.

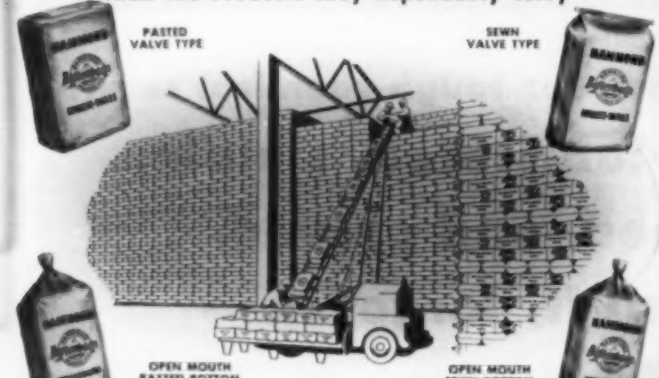
Suitable for use with aliphatic solvents: polyvinyl chloracetates and vinylidene chlorides suitably compounded to cause no impairment of resistance, halogenated polyethylenes, cellulose acetobutyrates, many alkyds, and the oil-resistant rubbers (acrylonitrile, neoprene, and Thiokol).

The solvency range of the aromatic hydrocarbons is much wider than that of the aliphatics and the suitable list is markedly reduced by the chopping out of the polyvinyl chloracetates and vinylidene chlorides. The oil-resistant rubbers will show a pronounced swelling with the aromatics which for some uses will destroy their usefulness.

The above is a discussion of material performance according to polar characteristics and applies predominantly to the thermoplastic materials. Except for usually non-significant susceptibilities, the thermosetting materials owe their inertness to a high degree of molecular cross-linkage which literally prevents molecular displacement into solution or swelling. Thus properly heat polymerized phenolics and furanes are resistant to so-

(Continued)

Much more goes into HAMMOND *Multi-Wall* BAGS
than the Products they dependably carry



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2. Hammond's two large plants are devoted almost exclusively to Multi-Wall Bag production.
3. Pride of workmanship and a thorough knowledge of your shipping problems assure you of Multi-Walls for your exact needs.
4. Modern machines and materials handling equipment keep costs and prices to a minimum.

Write for your copy of "To Serve You Better with Hammond Multi-Wall Bags"

HAMMOND BAG & PAPER COMPANY

General Offices: Wellsburg, W. Va. *Plants in* Wellsburg, W. Va. and Pine Bluff, Ark.

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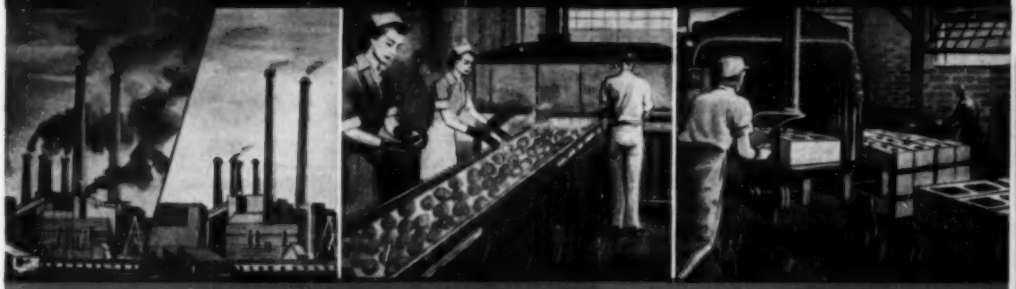
THE NAME TO WATCH IN CHEMICALS

D-40
is more than a detergent

The detergent base of many industrial and household cleaning compounds, Oronite D-40 has dozens of other uses. Its versatility and high quality are characteristic of the chemicals made by Oronite—a dependable source of basic ingredients for better products.



THREE TYPICAL INDUSTRIAL USES OF ORONITE D-40:

1 SMOG REDUCTION

Use of D-40 in smog control systems, removes hydrocarbons from stack gasses and prevents the formation of undesirable emulsions in the "scrubbing" solution. In actual practice this process has reduced exhaust smoke by as much as 90%, which offers a potential control of smog conditions in industrial areas.

2 AGRICULTURE

In addition to its value in washing many fruits and vegetables, Oronite D-40 is a tremendous aid in peeling these foods during canning and packing operations. Two distinct advantages are obtained; 1) immersion time and the concentration of alkali can be reduced and 2) the fruits and vegetables retain better color.

3 CEMENT

The use of Oronite D-40 in the production of cement products, such as building blocks, provides many distinct advantages. The texture of the finished product is improved, water requirements reduced, plasticity and workability are better and "stripping" from molds or forms is facilitated. In addition, the abrasive wear on mixing equipment is greatly reduced. All these contributions help cut production costs.

A partial list of other Oronite Chemicals

NOTICE
Some of the following are currently in short supply.

Detergent Alkane	Gas Odorants	Ortho Xylene
Detergent Slurry	Polybutenes	Para Xylene
Detergent D-60	Sodium Sulfonates	Xylol
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Lubricating Oil Additives	Naphthenic Acids	Hydroformer Catalyst
Cresylic Acids	Phthalic Anhydride	

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ORONITE CHEMICAL COMPANY

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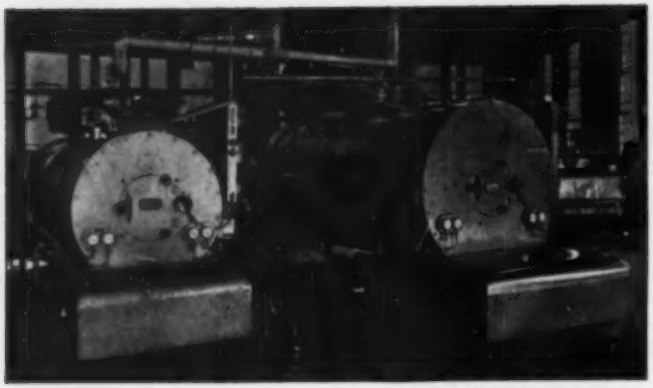

Multiple installation at Monon Railroad, Indianapolis, saves $1,000.00 per month in fuel and labor.

STEAM-PAK YORK POWER GENERATOR
A PRODUCT OF YORK-SHIPLEY

SAVE MONEY

They're Built For Maximum Efficiencies In Operation . . .

- Engineering design recognized by top engineers and architects.
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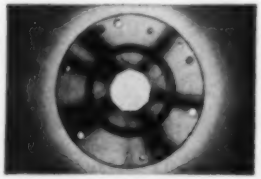
- Tremendous savings proven by hundreds of case histories.
- Distributors chosen for their engineering ability, trained to provide the best engineering "know-how."

These are four basic reasons why Steam-Pak should be No. 1 on your list of steam generators.
See your nearest York-Power Distributor or write York-Shipley for complete details.



IRIS SHUTTER
Patent protected feature provides precision control of burner air, accurately synchronizing air-oil adjustment.

NEW FIRE CONTROL
Swirling flame action speeds gas flow, increasing heat absorption and combustion efficiencies.

Steam-Pak Generators — from 15 h.p. up, for low or high pressure steam or hot water, for light or heavy oil, combination gas and oil or straight gas.

YORK SHIPLEY

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lution or solvation by all solvents regardless of polarity, and are completely and equally resistant to both aliphatic and aromatic solvents.

Silicones

J. A. McHARD and LEON VAN VOLKINBURG, *Dow Corning Corp., Midland, Mich.*

The resistance of silicones to hydrocarbons is generally rated as poor. This is due, however, to the solubility of most silicones in the lower molecular weight hydrocarbons rather than to chemical decomposition.

The solubility of the silicones decreases as the molecular weight of the hydrocarbon increases. Consequently, there are important uses for silicones in the petroleum industry where inertness and heat stability are more important than chemical resistance.

Silicone Elastomers—Hydrocarbons tend to swell silicone elastomers. The original properties are essentially regained, however, on reconditioning. Because swelling is not accompanied by permanent deterioration, silicone gaskets and seals have proved to be superior to organic rubbers in many applications involving hydrocarbons. In aircraft engines, for example, silicone pushrod seals and rocker box cover gaskets have many times the life of other resilient materials in contact with hot oil at operating temperatures in the order of 230 deg. C.

Silicone Resins—Cured samples of the various silicone resins tend to soften and crumble in contact with hydrocarbons. However, a resin used in fabricating silicone-glass-laminates shows good resistance to aliphatic hydrocarbons. All the resins show good resistance to mineral oil.

Tantalum

LEONARD R. SCRIBNER, *Fansteel Metallurgical Corp., N. Chicago, Ill.*

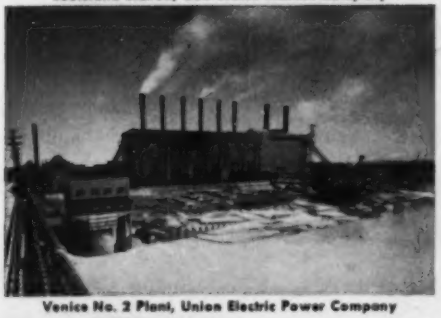
So far as it is known, none of the aliphatic or aromatic hydrocarbons attacks tantalum. There are of course many other materials inert to the hydrocarbons so that tantalum is not usually needed. In chlorinating hydrocarbons, or in absorbing byproduct HCl from chlorinated hydrocarbon processes, tantalum is a useful and economical material.

NOTE: *Materials of Construction vs. Hydrocarbon Solvents will be concluded next month.*—EDITOR

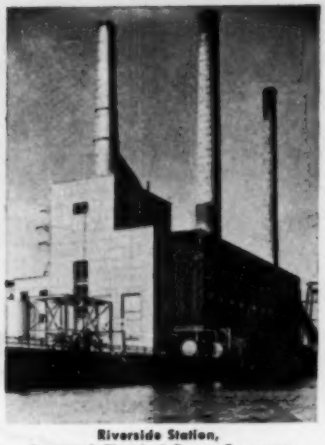
Hookers Point Station, Tampa Electric Company

Possum Point Station, Virginia Electric & Power Co.

Louisiana Station, Gulf States Utilities Company



Venice No. 2 Plant, Union Electric Power Company



Riverside Station,
Savannah Electric & Power Company

Designed & Constructed
by
Stone & Webster
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and using

OIC Valves are *precision engineered* and *precision built*. OIC engineers offer you *precision application* help.

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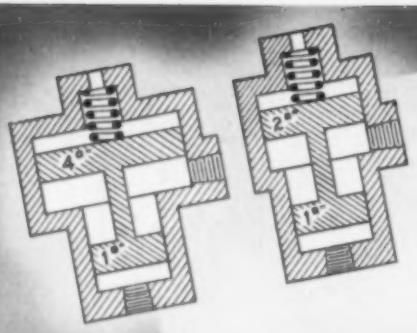


Do You Know Why

'HIGH RATIO' TRAPS *by* NICHOLSON DRAIN CONDENSATE FASTER?

IF you were asked, "Which of the two differential pistons sketched above will require the least pressure drop before the piston assembly can move up?" you would obviously answer, "The one at the left". Because of the higher ratio between the areas of its upper and lower pistons.

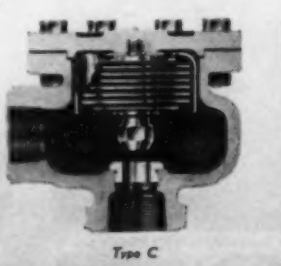
Now the line pressure in a thermostatic bellows trap is analogous to that in a differential piston. The higher the ratio of bellows area to discharge orifice area the less the pressure drop required before the bellows will contract and open the discharge valve.

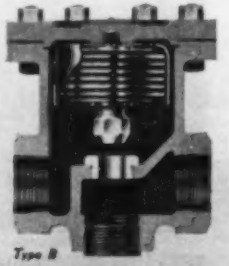
Getting down to cases, the Nicholson thermostatic trap has a larger bellows than any other trap of this type, while its discharge valve orifice is approximately equal in size to any other trap. This gives a higher ratio and causes the Nicholson trap to operate on the least temperature difference between steam and condensate.

Now take the case of two traps with discharge valves of equal size and assume that they are operating at a given temperature difference.

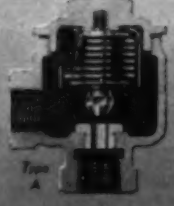
The Nicholson "High Ratio" trap will open its valve wider and have larger capacity than the low ratio trap.

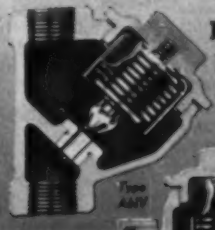
This is a reason why a Nicholson thermostatic trap operates faster and keeps a unit full of live steam. And, may we add, it's one of the advanced features that are influencing plant engineers increasingly to standardize on Nicholson.

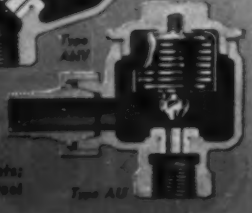

Type C


Type B

The two types above are cast iron; sizes ½" to 2"; pressures from vacuum to 225 lbs. Type C also in cast steel for pressures to 300 lbs.


Type A


Type AAIV


Type AIII

FIVE TYPES FOR EVERY PLANT USE

These three types are bronze; sizes ¼" to 1"; pressures from vacuum to 200 lbs. All five types have stainless steel valves and seats; bronze, monel or stainless steel bellows.

Send for NICHOLSON TRAP CATALOG 250

Catalog 250 contains capacity tables, installation diagrams, and data, charts and formulae for determining the proper size trap.

W. H. NICHOLSON & CO.

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Is your interest...

...in your profession limited to paying dues?
...in your company limited to your particular job?
...in your associates limited to "getting along?"

If so, then consider...

That June Graduate Is A Management Job For You

Edison didn't become famous because he was thinking about drip'less candles when the world was ready for the incandescent lamp. Neither are you, Mr. Engineer, going to achieve the boss's winning smile unless you become more than "a man with a slide rule and a formula to substitute into." You won't get to be boss yourself unless you as a professional man are attuned to your company's problems and what you can do to solve them.

Some bright Monday morning soon, you're going to get your chance. Here's how it will happen. Your boss is going to come into your department with this year's engineering graduate, the product of 16 to 20 years of educational development; the result of many thousands of dollars invested.

The boss has had his best men scouting the engineering schools from MIT to Podunk U. He's signed up the bright youngsters at twice what they're worth and thrown in the key to the company to boot. Engineers are short, darned short, and he was glad to get his share.

What happens now? Does management become the collector who hunts to the ends of the earth for a rare stamp only to bury it in an album—in a drawer—in a cabinet—in a corner! That—to a very large degree—is up to you.

You like cool, logical thinking, so let's apply some of it.

First, like it or not, your department's blood stream is going to be innoculated with a new serum, *Apprenticus Collegium*, untried, unproved, unseasoned. Like any other serum, it can pep up an old bag of bones or break down the best of the thoroughbreds.

Second, your company has a valuable investment in this graduate, and his value is increased by the fact that right now he is practically irreplaceable.

So far, you've had nothing to say. You didn't choose this fellow, but you're going to have to live with him. Whether he gives you ulcers or a promotion is up to you. Before you make up your mind, here are some thoughts.

All it takes is common sense and a little seasoning of the Golden Rule and you've got a happy, contented, integrated employee who'll work his head off and his heart out because he likes his job and his associates, knows and takes pride in his company and *his* part in it. Or you can sit back. But remember, it takes more than a slide rule and set of formulas to make a professional man—or a company president—and Opportunity *still* hasn't any bruised knuckles.

No matter who you are, no matter what your job, this new departmental feature in Chemical Engineering is prepared for you. Every month we are going to help you do your job better. No matter what side of the managerial fence you are on you're going to profit from the facts, figures and fancies that we have prepared for you.—RVR

All right, you break your neck being a one man ambassador for the company while assignments of the moment—maybe rush defense orders go a-begging. What do you get out of it besides a sweat? This:

1. Proper credit from your superiors. Management is always looking for bright ideas from bright people. The company is spending thousands on its indoctrination program. If you can implement this program at no cost to the company, and if you can accomplish as much, or more, there's no doubt you'll be rewarded. Something to remember: do a good job and you can be sure that the boss will know it.

2. You'll make a firm friend, a worthy and willing associate, a definite asset to your department, your group, or your project.

3. You'll have the satisfaction of doing a fellow engineer a service as well as the profession.

Remember your first day on the job? You were pretty much alone in a big city. You'd taken that small, dingy room on the East side of town. The price was too high and the furnishings would have been spurned by the Collyer brothers. You met 35 people that first day and you remembered the names of two. They gave you a wheelbarrow to push and if you'd had the fare, you would have dropped it and been on the first train home. You realized some time later that the company was a pretty good one and you were lucky to be associated with it—but you had to travel the bumpy road. Well this young fellow is pretty much in the same position as you were.

In short, he needs a friend and you can be that friend—to your mutual advantage.

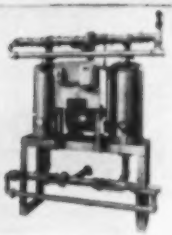
One major company is using a technique that should become more popular in industry. They assign to each new trainee a technical "big brother," a senior member of the organization who is engaged in the same type of work for which the new man is being trained. This "big brother" is the man who listens to the trainee's problems and ideas.

Using this technique, here are just a few of the things you can do. With a little thought and an eye to the particular problems of your own company, you can double or treble this list.

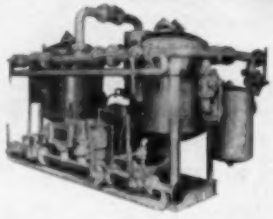
Attitude—The boss is darned interested in the graduate's attitudes—toward his job, his company, his associates. The graduate, in turn, is going to be influenced by you. Incidentally, let's inject a word or two about your attitude toward the newcomer—and the attitude of all the other engineers toward him. This new fellow might strike you as a "know-it-all." If he does, be tolerant—or at

(Continued)

Standard or Special...



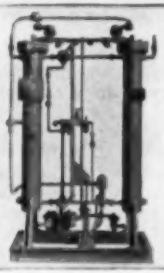
This Kemp Radiation-Cooled Dryer gives maximum efficiency with minimum maintenance and operating costs. Heating period terminates automatically. Rated: 300 scfm, 100 psig, 70° F.



This electrically activated Kemp Dryer is designed so gas stream is not contaminated by air normally used for reactivation. Rated: 3200 scfm, 100 psig, 70° F.

KEMP can Solve...

This Semi-automatic Kemp Oriad Dryer dries air for actuating tools, valves, etc.—dries process air and gases. Rated: 600 scfm, 100 psig, 70° F.



This Kemp Oriad Dryer is controlled by program timer. All operations, including tower reversals, fully automatic. Rated: 100 scfm, 100 psig, 70°F.

Your Moisture Problem

DRIES AIR, GASES or LIQUIDS TO NEW LOW DEW POINTS FOR AS LITTLE AS ¼c PER MCF

Whatever you pay for drying air, gases or liquids, check on the economy of Kemp Dynamic Dryers! Hundreds of Kemp Dynamic Dryers control moisture at low cost in plants all over the country. Operation is guaranteed to your specifications. In fact, many Kemp users report drying to sub-zero dew points for as little as ¼c per mcf—including all charges for labor, capital investment and materials!

Flexible Design

Kemp Dynamic Dryers are versatile — offer manual, semi-automatic or automatic operation. Desiccant is especially selected and compounded for the type drying you require. With Kemp you can dry air, gases or liquids, eliminate moisture in materials, and control humidity in large or small areas. Gas, electric or steam regeneration is supplied as standard equipment.

Find out how Kemp engineering can save you money!

KEMP OF BALTIMORE **DYNAMIC DRYERS**

Write For Bulletin D-27 for technical information. Address: C. M. KEMP MFG. CO., 405 E. Oliver St., Baltimore 2, Md.

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least reserve judgment until you've had a chance to become better acquainted with him. Chances are he's only trying to help, even though, perhaps, he's let his desire to make good run away with him.

Keep in mind the fact that this is his period of greatest sensitivity. This bundle of hopes, fears, desires and inhibitions we call a human being is going to read a deluge of pamphlets on his company's generous employment practices, on free enterprise, on loyalty to the company, on all sorts of things that management would like him to know. He's going to read these things, think about them, then look at you to see if they make any sense. If management has told him that perspiration will be rewarded with promotions and salary increases, and then he hears you say "nobody ever gets promoted around here," or make some equally careless misstatement of fact, jestingly or otherwise, all of the boss's efforts go down the drain in a matter of seconds. If you're going to be a source of contagion, infect your associates with the right attitudes, not the wrong ones. You'll find that some of your attitudes might improve too.

Personal—Can you help him find a place to live? Can you explain the city's transportation system, places of interest to visit in his spare time, good places to eat, etc.? If you can do any of these things without much trouble, you certainly ought to. Selfish motives aren't advocated, but a little sincere politicking won't hurt you at election time.

Details of the Job—Often overlooked in the indoctrination of the new man are such things as how to file an expense report, where to go for supplies, etc. Too often the routines of the engineering department are overlooked, leading to unnecessary confusion and friction. You can help prevent this by taking a few minutes to show him the hows, whys and wherefores of these details which are often overlooked as trifles. Start him right and he won't bother you later.

Job Shortcuts and Kinks—You haven't been on the job for years without picking up a lot of first hand knowledge that isn't in the books. Shares these gems with your new associate. It won't be long before he repays you with some ideas of his own.

Safety Experience—Here, too, your experience may be able to augment the rules. You may know more about the hazards and potential hazards of your particular plant or department

(*Continued*)

Here's low-cost, mineral-free water

Do you want an inexpensive, high-quality substitute for distilled water? Permutit Demineralized Water may be used instead of distilled water for almost all purposes . . . at a fraction of the cost. It's today's big water bargain! ¶ In this process, Zeo-Karb H,® Permutit's acid-regenerated organic cation exchanger, replaces metallic cations in the water with hydrogen ions. The salts present are thus converted into corresponding acids, which are then removed by De-Acidite,® a resin-type anion exchanger. ¶ It's advantageous to replace distilled water with Permutit Demineralized Water. For full information, write to The Permutit Company, Dept. CE-6, 330 West 42nd St., New York 18, N. Y., or to The Permutit Co. of Canada, Ltd., Montreal.

WITH THE Permutit® Demineralizing Process!

ANALYSES OF 4 IND. DISTILLED WATERS & 4 IND. DEMINERALIZED WATERS

Distilled Water Plant	A	B	C	D
Hardness as ppm $CaCO_3$	0	10	0	15
Alkalinity as ppm $CaCO_3$	13	18	4	12
Sulfates as ppm SO_4	0	0	3	3
Chlorides as ppm Cl	4	0	1	3
Total Salts as ppm $CaCO_3$	19	18	9	21
Demineralized Water Plant	**A**	**B**	**C**	**D**
Hardness as ppm $CaCO_3$	0	0	0	1
Alkalinity as ppm $CaCO_3$	3	4	2	4
Sulfates as ppm SO_4	0	0	0	1
Chlorides as ppm Cl	0	0	0	0
Total Salts as ppm $CaCO_3$	3	4	2	5

REGENERANT COSTS & RAW WATER ANALYSES: 4 IND. DEMINERALIZING PLANTS

Plant	A	B	C	D
Hardness as ppm $CaCO_3$	43	116	212	281
Alkalinity as ppm $CaCO_3$	24	58	140	188
Sulfates as ppm SO_4	19	70	80	69
Chlorides as ppm Cl	4	2	34	10
Total Salts as ppm $CaCO_3$	84	149	274	277
Regenerant Costs per 1000 gals.	$0.03	$0.08	$0.13	$0.13

SAVES YOU UP TO 95¢ ON YOUR DISTILLED WATER DOLLAR!

Permutit

WATER CONDITIONING
ION EXCHANGERS
MATERIALS AND EQUIPMENT

PHILCO finds

"platecoils have better heat conductivity than any similar coil"

The Platecoil method of tank heating is being used by the Philco Corporation of Philadelphia in the process plating of metal parts for radio and television sets. Although the Platecoils haven't been used very long, Philco production officials say they are "most pleased with the results that have been thus far obtained." They've found that, at least in their operation, the Platecoils are self cleaning . . . which saves many hours of maintenance time. They've found, too, that Platecoils have a much higher rate of heat conductivity . . . which means faster tank heating.

Platecoils have a greater BTU transfer because they have more prime surface in a given area. A 22"x47" Platecoil gives the same heat transfer surface as 32 ft. of 1½" pipe. Thus Platecoil saves about 50% over equivalent pipe coil. Think what this means to you in lower initial cost, lower installation and handling costs.

Learn too, how Platecoils can be replaced without dumping the tank solution . . . . how they can be thoroughly cleaned in a matter of minutes. Write today for bulletin No. P61.

The Platecoil method of tank heating is used at the Philco Corporation in the process plating of metal parts for radio and television sets.

PLATECOIL gives you these ADVANTAGES

- Cleaned and Repaired Without Dumping Tank Solution
- Greater BTU Transfer Per Unit Area
- Weighs Only Half as Much as Pipe Coil
- No Threaded Joints in Tank
- Increased Tank Capacity
- Fast, Easy Installation
- Easy to Clean

PLATECOIL

KOLD-HOLD MFG. CO.

LANSING 4, MICHIGAN

than does the safety inspector. Remember, your life is no safer than is the life of your most careless associate.

Technical Societies—You'll want to show the new man the workings of the various technical societies that he'll be interested in. Introduce him to the other members, make him feel at ease. Try to get him off on the right foot so that he'll be more than just a "jiner," who pays his dues and attends an occasional meeting. He contributes nothing to a particular society and conversely, the society contributes nothing to him. Better members mean better societies mean a better profession.

Technical Literature—How do you keep up? Someone has said "a man is no better than his information." This is probably more true of chemical engineers than anyone else for no industry is breaking down technological barriers faster. Pointing out the best of the material to the graduate will save him much time and effort, and you might work out a system for sharing valuable information.

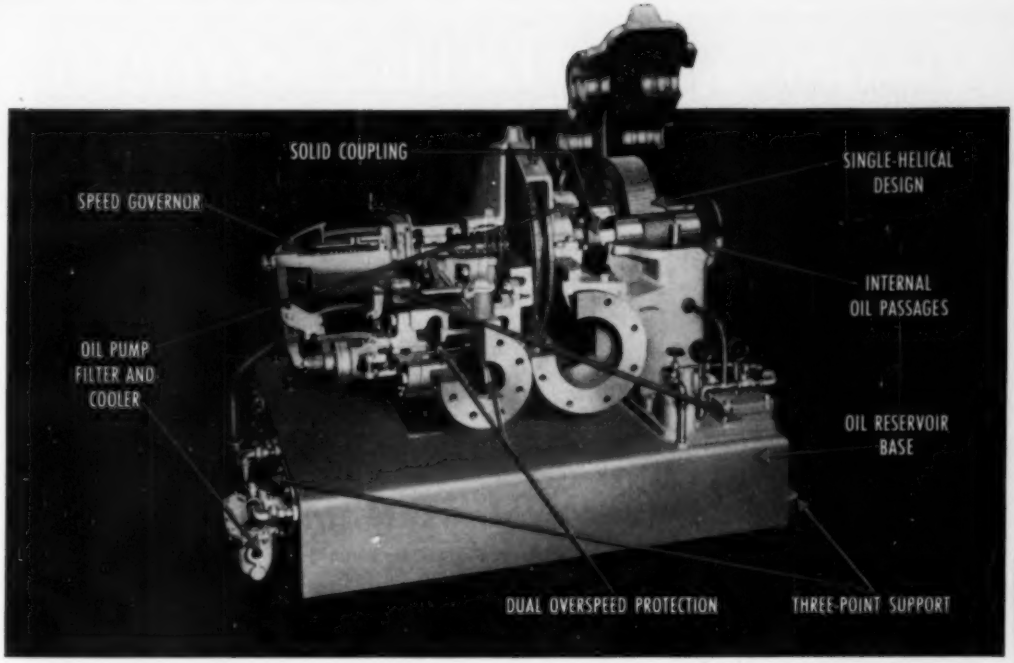
Tips on Getting Along—Is the department head a teetotler? Then you won't want the fledgling boasting about his capacity for scotch. If the boss is fussy about punctuality, it would be wise to let the graduate know it. Has anyone else in the organization, any pet peeves? Are there any taboos? Misunderstandings begin easily, can usually be prevented just as easily. We all have our idiosyncrasies and a knowledge of the other fellow's is the surest way to avoid stepping on sensitive toes. The new member will appreciate your tips and everyone will benefit. It'll make a pleasanter place to work, too.

Ethics—Last, but perhaps, most important of all, will be the effect of your example. Engineers are professional men and, as such, they have responsibilities to themselves, their employers and their profession. The importance of keeping confidential matters confidential, loyalty to one's employer, honesty, good taste and the like, will be influenced to a great extent by you. Again, as the profession advances, you advance.

In short, make the new engineer a valuable engineer and when promotion time comes around, your name, like Abou Ben Adhem's will "lead all the rest."

(The editor wishes to acknowledge the assistance of John Bennett, of Union Carbide and Carbon Co., who made a number of valuable suggestions in the preparation of the manuscript.)

—*End*



TYPE E Gearturbines

Cost Less to Buy . . . Less to Operate

Here's the ideal steam drive for ratings up to 500 hp and output speeds commonly found in single-ended applications such as pumps, fans, compressors, line shafts and generators. It's the Westinghouse Gearturbine that saves you money right from the start. You save on its purchase . . . you save on operating costs.

Save on purchase price because the Westinghouse Gearturbine comes as a complete package. It costs much less than buying a turbine and a separate speed reducer . . . costs less to install, too!

Save on operating costs because every turbine part has been built to give long life and dependable service. An anti-corrosion treatment on vital parts reduces wear and maintenance . . . and there's dual protection against overspeed.

You get these additional features:

Solid coupling of turbine shaft to pinion shaft, makes it easy to align pinion bearings with turbine bearing.

Single-helical gearing; endwise movement of one shaft will not affect axial location of the other. Running clearances are maintained.

Internal oil passages avert accidental damage, improve appearance.

Forced circulation of filtered oil assures thorough lubrication of gears and bearings.

3-point support for maximum ease in leveling and aligning.

Unique oil reservoir forms sturdy base for unit . . . simplifies mounting and installation.

Type E Gearturbines are available in any combination of three wheel sizes, three gears and three types of governor. Your nearby Westinghouse representative has all the facts. Ask him for Booklet B-4346, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50524

YOU CAN BE SURE . . . IF IT'S

Westinghouse

TYPE E Gearturbines

Names in the News Edited by Frances Arne

MAN OF THE MONTH

Ernest W. Reid

. . . new president of Corn Products Refining Co. He joined the company in 1943 as vice president of research and development.

To give us the why of Ernest W. Reid's progress, we applied to a few of his longtime associates. The answers: "Above all, his tact and understanding of men are characteristics which have contributed to his successful career." . . . and again . . . "Dr. Reid is rather quiet and somewhat reserved, but the genuine regard which his fellows have for him, and particularly those who have worked under his supervision, is shown by the number who will attend any dinner at which they know he will be present."

Dr. Reid graduated from Southwestern College at Winfield, Kan., with a degree in organic chemistry. He went on to the University of Pittsburgh where he received a Master's degree in organic chemistry and a Ph.D. in chemical engineering. At Mellon Institute, he worked on the development of chemicals from petroleum and natural gas. Following his service there, he went to work at a chemical plant of Carbide and Carbon where he was later promoted to plant superintendent. He is also familiar with sales, having established and directed sales development and assisted in establishing a sales company for Carbide. Then as European representative, he handled all phases of the company's business there.

During World War II, he offered his services to his country. Under his leadership the Chemicals Division of WPB grew from a unit of less than a dozen employees to a fully integrated organization of about 500 members. When he resigned in 1943 he was deputy director general of the entire WPB. At Corn Products, he has organized a completely integrated chemical division.

As to hobbies, fishing is probably the one he enjoys most. He has a well stocked pond on his farm in Kansas. The operation

(Continued on page 239)

E. T. Asplundh. President of Southern Alkali Corp., subsidiary of Pittsburgh Plate Glass. Associated with Pittsburgh's chemical operations since 1919; vice president in charge of Columbia Chemical Division since 1940; vice president of Southern Alkali since 1944. In a newly created position as chairman of Southern's board of directors: **Clarence M. Brown.** Board chairman of Pittsburgh Plate Glass since 1931; member of Southern's board of directors since its incorporation that year.

Richard W. KixMiller. Assistant general manager of the chemical division, Celanese. **Kenneth D. Bowen:** new manager of the division's plant operations; continues as plant manager at Bishop, Tex. **John H. Frick:** plant manager of the new chemical plant to be built at Pampa, Tex.

George Shannon Forbes. To receive the $1,000 James Flack Norris Award, first national award for outstanding achievement in the teaching of chemistry (presented by the Northeastern section of ACS). Professor emeritus of Harvard (1909-1948). Harvard graduate, A.B., A.M., Ph.D.

G. A. Nelson. Manager of the Wyandotte, Mich., works, Pennsalt; formerly superintendent there. **James M. McWhirter:** workers manager of the company's southern plants; formerly superintendent at Calvert City, Ky.

A. J. Krell. Chief of the fuel and chemicals branch of the Houston district Office of Price Stabilization. Formerly, field instructor, control of atmospheric and stream pollution, Texas A & M.

George W. Naylor. To manage Koppers' Washington, D. C. office. Company vice president. Formerly, chemical division development section manager.

James T. MacKenzie. Winner of the 1951 Herty Medal, awarded by the Georgia section of ACS for outstanding contributions to chemistry in the Southeast. Technical director of the American Cast Iron Pipe Co., Birmingham, Ala. Known for his report on German centrifugal casting methods, following a mission to Germany in 1945 for the Federal Foreign Economic Administration.

R. E. McNulty. Manager of the new Madison, Ill., division of Dow. Formerly production manager for magnesium wrought products at Midland. New chief metallurgist for Madison: **G. Ansel.** Has been process development director of the magnesium laboratories.

Edward Montgomery. Assistant to the executive vice president, Chemical Construction Corp. Brigadier General, U. S. Army, Retired. With the Chemical Corps for 23 years.

H. I. Schlesinger. Recipient of the Honor Scroll of the Chicago chapter, American Institute of Chemists. Professor emeritus at the University of Chicago. Honored for his research in inorganic chemistry, particularly on hydrides of boron and related compounds.

E. S. Brumberger. Production manager, industrial and chemical divisions, Publicker Industries. Joined Publicker in 1947 as assistant plant manager of Bigler Street industrial alcohol plant in Philadelphia; in 1949, plant manager. Graduate of NYU. Previous employers: Fiberoid Co., Du Pont, Delaware Rayon Co., Tee-Pak Co.

E. S. Brumberger

C. L. Dickinson

C. L. Dickinson. From process control manager of Diamond Alkali's Deer Park, Tex., plant to director of plant engineering and process work at Kolker Chemical Co.'s plant at Greens Bayou, Houston. With Diamond three years. Previously chief of process engineering and head of the development department for Weyerhaeuser Timber Co., Longview, Wash. Chemical engineering graduate of North Carolina State College.

(Continued)

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Chemical Engineers Achievement Award Winner

He's the sole inventor of Pfizer's unique Q-process for the recovery of terramycin.

At a drugstore lunch counter the other day some of us got talking about the new antibiotic that Pfizer put on the market last February. The soda jerk was interested. "We got terramycin here," he volunteered, eyeing us like a teacher who finds his pupils three lessons behind. That big step from laboratory to drug store had been fully accomplished in well under two years. The reason: Edwin W. Blase, 27-year-old project engineer with Pfizer. The byproduct: He's the winner of the first achievement award of the Chemical Engineers of Greater New York, to be presented annually "In recognition of exceptional service to humanity and his profession by a young chemical engineer under the age of 32, resulting from his contributions in chemical engineering."

His group had been assigned to try out solvent extraction methods for the recovery of terramycin. A white precipitate kept gumming up one of their tests involving quaternary ammonium salts. Blase was the only one who viewed it with anything but annoyance—he was curious. He discovered it was the result of an uncharted reaction between the salts and terramycin. That discovery still didn't get a rise out of anyone else. A month went by and his request for authorization to pursue the thing further got no response. He began to get "kind of irked." So he took it on himself to go a step further. He neutralized the precipitate—nothing but an unlikely looking black liquor. Disgusted, he couldn't quite bring himself to throw the mess out—it sat on his lab bench until the janitor began to revolt. Blase gave it one more chance—he acidified it. Out came beautiful yellow crystals. They marked the end of resistance movements all around. Blase's simple, direct "Q-process" needed only one pilot plant test before full-scale operations could begin.

Edwin Blase—tall, blond, quiet—is a farm boy from St. Charles, Mo. He wouldn't have gotten to high school except that a school bus started running the year he needed it. By the time he was ready for college his interest had been focused on chemical engineering by a cousin who had gotten his degree and gone on to specialize in biochemistry. He financed himself through two years at the Missouri School of Mines with two scholarships and by typing for the college library. The Navy V-12 did the honors for the remaining two years at the University of Kansas.

He came to Pfizer in Brooklyn in 1946. He and Mrs. Blase live in Carle Place, L. I. They have a son, Billy, and a very young daughter, Joanne. Mr. Blase is currently working for his masters at Brooklyn Poly. He spends a lot of his spare time gardening—and there he's made another discovery. Fermentation byproducts (rather plentiful around Pfizer) make highly efficient lawn fertilizers.

J. W. Bertetti. To assistant general manager of Pan-Am Southern's Destrehan, St. Charles Parish, La., refinery, from manager of El Dorado, Ark., refinery. To handle expansion program.

Robert A. Lees. On loan to NPA as advisor on the allocation of liquid latex. Regularly, manager of the Akron laboratories of American Anode, Inc. Advisor to the Rubber Bureau during WPB. With Akron company for 22 years; supervised construction of company's California plant in 1946, plant manager for three years.

Hervey J. Skinner. Retired from chemical consulting firm, Skinner & Sherman, Inc., organized by him in 1921. Previously with Arthur D. Little for 17 years.

Arthur B. Lamb. Winner of the 1951 Austin M. Patterson Award in the Documentation of Chemistry, sponsored by the Dayton section of ACS. Emeritus professor chemistry, Harvard. Editor for 32 years of the *Journal of the American Chemical Society*.

George J. Verbeck. From a senior research chemist of Portland Cement Assn.'s research and development division to manager of the division's applied research section. Studied at Lawrence College and the University of Chicago. First joined the association in 1941 as assistant chemist. During the last war, with the Institute of Gas Technology and Koppers, butadiene division.

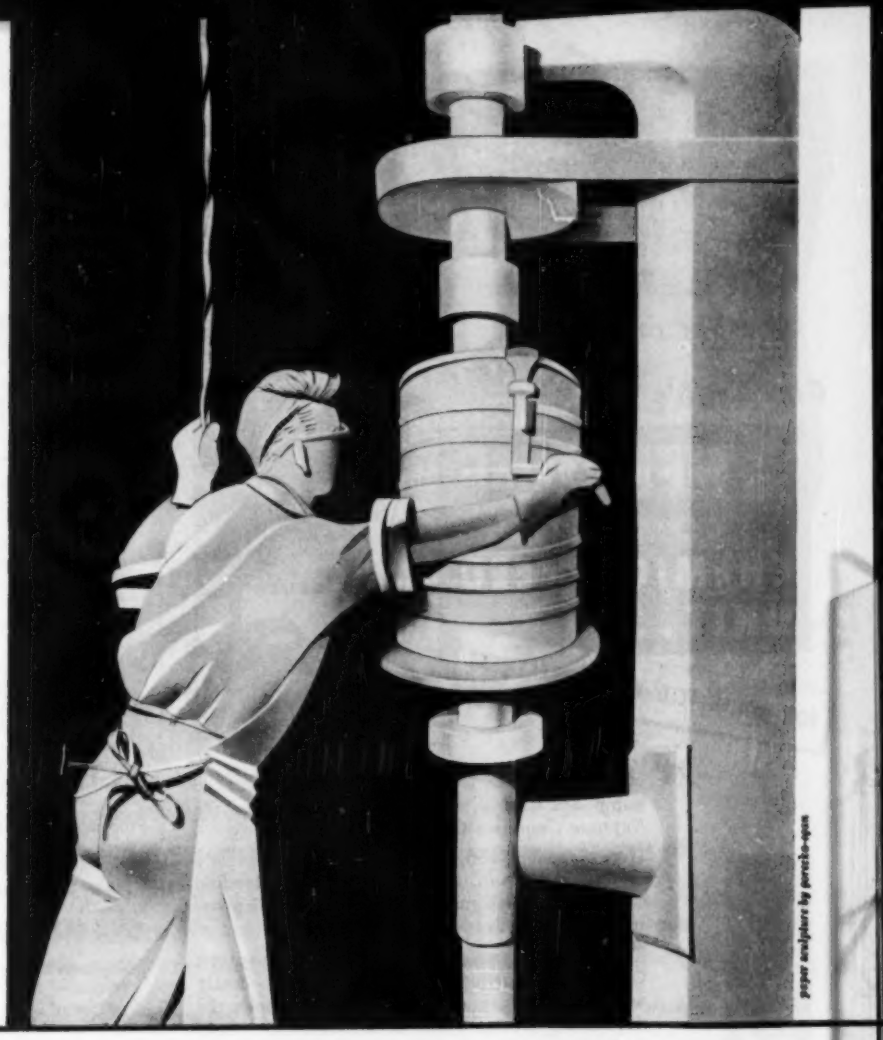
Ralph C. Tallman. Director of research, Lion Oil Co., El Dorado, Ark. With Lion since 1950 as manager of the planning and survey department, research division. Graduate of Cornell College, Mt. Vernon, Iowa, and Cornell University, Ithaca (Ph.D., 1931); instructor in organic chemistry for four years at Cornell University. Research director for Schieffelin and Co., 1935 to 1943; project leader and patent chemist in the central research laboratory, Allied Chemical and Dye Corp., 1943-1950.

Raymond E. Kirk. Recipient of the 1951 Honor Scroll of the New York chapter of the American Institute of Chemists. Head of the chemistry department, Polytechnic Institute of Brooklyn.

A. E. Stevenson. Winner of the Nicholas Appert Award for 1951 presented by the Chicago section of the Institute of Food Technologists. Technical assistant to the general manager, research department, Continental Can Co. Authority on the chemical relationship of foods to metal surfaces.

W. D. Thomas, Jr. From group leader

(*Continued*)



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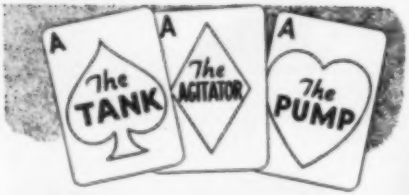

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NAMES IN THE NEWS, *cont. . .*

to technical representative, petroleum chemicals department, industrial chemical division, American Cyanamid Co. To assemble and correlate technical information gained in the field for guidance of Cyanamid development programs. Graduate of Penn State and Columbia. Joined Cyanamid in 1940.

Raphael G. Kazmann. Consulting ground water engineer in Stuttgart, Ark. Formerly chief hydrologic engineer in charge of investigation and research for Ranney Method Water Supplies, Inc., Columbus, Ohio.

Robert Wier III. Member of the buying staff of the purchasing department, Hercules Powder Co. Has been assitant product supervisor of the Chicago sales office. Chemical engineering graduate of Yale. Joined Hercules in 1941, as a chemist at the company's Virginia Cellulose plant at Hopewell.

W. F. Dillingham. President, Chem-File, Inc., an organization which collects complete technical data on chemicals and materials and supplies the alphabetized material in permanent cabinets. Formerly with Reinhold Publishing.

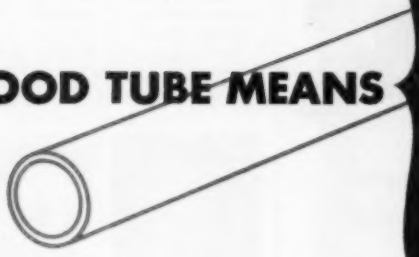
Frederic H. Adams. Research associate, Calco Chemical Division, American Cyanamid. With Calco since 1933; group leader in the research department since 1939. Studied at Wesleyan and Princeton.

J. J. Leavitt. Group leader, organic section of the chemical research department, Calco Chemical Division, American Cyanamid. Became a member of Calco's chemical research department in 1944. Graduate of Harvard.

Charles A. Thomas. President of Monsanto Chemical Co.; has been executive vice president since 1947. Studied at Transylvania College and MIT. As research chemist for General Motors, worked on anti-knock materials for motor fuel and extraction of bromine from sea water, 1923-1926. Co-owner of Thomas & Hochwalt Laboratories, Dayton, until it was acquired by Monsanto in 1936. Monsanto positions: central research director; member of the board of directors; vice president and technical director; member, vice chairman, then chairman of the executive committee. During World War II: in charge of purification and

(*Continued*)

GOOD TUBE MEANS



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more economy
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metallurgy of plutonium; project director of Clinton Laboratories at Oak Ridge.

Carl W. Hedberg. Vice president of Research Corp., New York. To continue in charge of operations at the Bound Brook, N. J., plant. Joined the company in 1916 as development engineer. In charge of technical development since 1927.

C. W. Hedberg

R. Mattair

Robert Mattair. Assistant director of technical service division, Oldbury Electro-Chemical Co., Niagara Falls. Previously, research chemist with B. F. Goodrich. Studied at Harvard and Ohio State.

Paul W. Leppla. Technical director, Dicalite Division, Great Lakes Carbon Corp., with headquarters in Los Angeles. Joined Great Lakes Carbon four years ago. Most recent position: associate director of research at the Morton Grove, Ill., research laboratory. Previous employer: Cardox Corp. (manager of chemical plants). Doctorate from the University of Illinois.

Leo J. Sobell. Representative in the New York Metropolitan area for American Cyanamid, Calco Chemical Division, pigment department. Chemical engineering graduate of the University of Alabama.

Fred C. Hanker, Jr. Assistant to the president, Catalytic Construction Co., Philadelphia. Has been process engineer, Standard Oil Development. From 1944 to 1948, assistant to the vice president of manufacturing department, Carter Oil Co. Chemical engineering graduate of the University of Pittsburgh.

Andrew Kalitinsky. Manager of the special projects department, M. W. Kellogg. To work on development of rockets and rocket fuels. Formerly chief engineer of the nuclear energy for propulsion of aircraft project, Fairchild Engine and Aircraft Co. Studied at the Swiss Federal Institute in Zurich.

Ernest W. Reid

(Continued from p. 232)

of the farm is another enthusiasm. There he combines agriculture and science as well as at Corn Products though the order of importance is reversed. Another one-time hobby should also be mentioned because of the enduring effect it has had. While at Southwestern, Dr. Reid was captain of the college tennis team. Attending college at the same time was a crackerjack tennis player, Leila English. The team of English and Reid on the tennis courts after college became the domestic team of Mr. and Mrs. Ernest Reid.

William S. Richardson. A vice president of B. F. Goodrich Co. Continues as president, B. F. Goodrich Chemical Co. of Cleveland. Goodrich history: Joined the staff of the works manager in Akron as manager of the planning department; staff superintendent of the industrial products division, merchandising manager then general sales manager of the division; general manager of the industrial products and sundries sales division.

Ralph H. Manley. On a two-month tour of the European chemical industries in his capacity as director of General Mills' research department in Minneapolis.

Lowell L. Fellinger. Coordinator of technical personnel procurement for Monsanto's organic chemicals division. Retains title as assistant director of the research department. Studied at the University of Illinois and MIT. Joined the organic chemicals division in 1941 as research chemist; pilot plant group leader, 1944; assistant director of research, 1947. His successor as assistant director of research in charge of pilot plant and interim production facilities: **Robert E. Howard.**

John B. Windsor. Manager of the Fairmont, W. Va., plant at Reilly Tar & Chemical Corp., Indianapolis. New plant superintendent: **John Campione.** Head of plant development: **P. A. Neri.** All three have been connected with the plant for a number of years.

Al Vande Weghe. Transferred to Du Pont's Wilmington headquarters; has been assistant superintendent of the polychemicals department at the Orange, Tex., plant. His successor: **J. H. Covington,** supervisor in the polythene division.

A. J. Passonno. Recalled to active duty as a major in the engineers. Has

(Continued)

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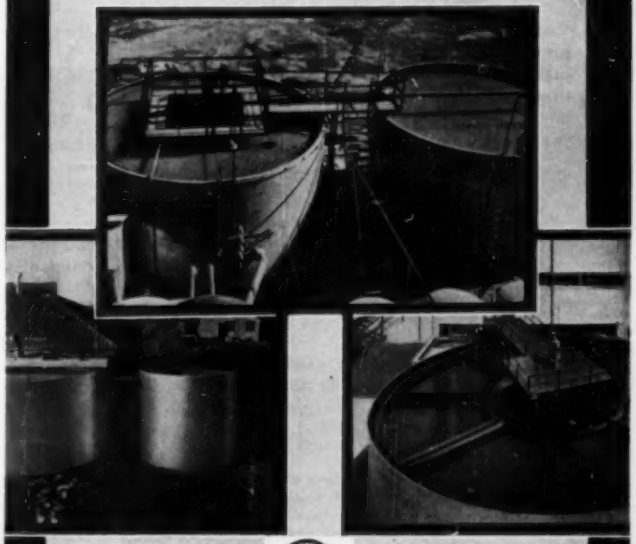

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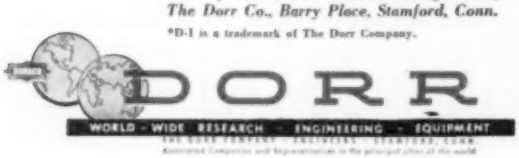


been president of Passonno Corp., Watervliet, N. Y., protective coatings manufacturers. From 1942-1946: chief, protective coatings section, engineer board, Fort Belvoir, Va.

Lloyd V. Sherwood. Manager, agricultural chemicals of Monsanto's organic chemicals division development department. Has been with central research department at Dayton. First joined Monsanto in 1946. Studied at the University of Illinois.

Roy H. Walters. Director of research and development, General Foods. Company history: chemical engineer at the Post Cereals Division, Battle Creek, Mich., 1934-1939; at central laboratories in Hoboken—head of chemical engineering division, director of engineering research laboratories, technical assistant to the director of research and development. Studied at the University of Wisconsin.

R. H. Walters

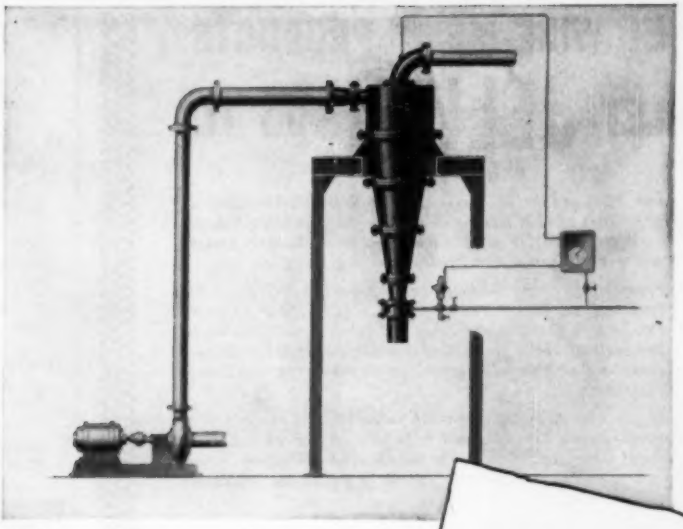
A. D. Miller

A. D. Miller. New member of the staff of the director of chemical laboratories, Firestone Tire & Rubber Co.; has been general manager of synthetic rubber division since 1947. Studied chemical engineering at Capital University and Case. With Firestone for 17 years. Head of the technical division of the company-operated Rubber Reserve Plant in Akron; technical manager for all company-operated synthetic rubber plants. His successor as general manager: **C. A. Hill,** formerly manager of the company-operated Rubber Reserve Plant, Lake Charles, La.

L. B. McKnight. In a newly created position as executive vice president, Chain Belt Co., Milwaukee. Formerly, a vice president. To revamp managerial organization.

M. H. Arveson. Director-at-large, ACS. Technical director, Indoil Chemical Co., Standard Oil (Indiana) subsidiary. With Standard

(*Continued*)



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#2	3.5	22.1	69.8	5.8	93.88	97.07	36.9
#3	6.0	13.3	67.2	4.4	97.23	88.07	25.5
#4	5.5	28.7	76.6	5.1	97.55	93.24	41.4
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CLARKSON CHEMICAL FEEDERS

MODEL "E" in STAINLESS STEEL
MODEL "F" in TEFLON PLASTIC

For all liquids, including corrosive reagents

Accurate measurement From two drops to two liters

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THE CLARKSON CO. 564 MARKET ST · SAN FRANCISCO 4, CALIFORNIA

NAMES IN THE NEWS, *cont. . .*

since 1924. Studied at Lawrence College, Wisconsin, Chicago and Northwestern universities.

M. L. Crossley, Florence E. Wall and **John R. Bowman.** New councilors, for three-year terms, American Institute of Chemists. Dr. Crossley: consultant, American Cyanamid. Miss Wall, consultant in cosmetics, technical writing. Dr. Bowman, head, department of research in physical chemistry, Mellon Institute.

Warren A. Beman. To direct chemical products development for Socony Vacuum Oil Co. Formerly in charge of textile work for chemical products division. Chemical engineering graduate of Purdue, 1940.

W. A. Beman

B. W. Gamson

Bernard W. Gamson. From chief process engineer to director of the research and development division, Great Lakes Carbon Corp., Morton Grove, Ill. Joined the company in 1943.

Kent H. Smith. Chairman of the board, Lubrizol Corp.; has been president since its establishment in 1928. New president: **Kelvin Smith,** former vice president in charge of research and development. Both are graduates of Dartmouth and Case School of Applied Science.

Kenneth E. Mulford. General manager of Atlas Powder Co.'s industrial chemicals department; has been assistant general manager since 1948. Graduate of George Washington University. Joined Atlas in 1934. New director of the research and development department: **J. Peter Kass,** director of organic research since joining Atlas in 1947. Previously with Interchemical Corp. Doctorate from the University of Minnesota.

George E. Ziegler. Director of research for Zonolite Co., Chicago. Formerly held a similar post with Midwest Research Institute, Kansas City, Mo.

G. D. Creelman. From director of research to research coordinator, M. A. Hanna Co., Cleveland. His successor: **D. N. Vedensky.**

George O. Curme, Jr. Vice president in charge of research, Union Carbide and Carbon Corp.; has been vice president in charge of chemical research since 1948. Vice president of company division: Bakelite and Carbide and Carbon Chemicals (his research work on acetylene at Mellon Institute resulted in the latter division's formation). First to develop chemistry of aliphatic compounds in U. S. Awards: Perkin Medal, 1936; National Modern Pioneer Award, 1940; Willard Gibbs Medal, 1944; Fellowship in the New York Academy of Science, 1950. Studied at Harvard, Northwestern, University of Chicago (doctorate), with Fritz Haber at Kaiser Wilhelm Institute and with Emil Fischer at the University of Berlin.

Kenneth H. Klipstein. From deputy director to director, chemical division, National Production Authority. On leave as assistant general manager and head of the technical department, Calco Chemical Division, American Cyanamid. He succeeds **Joseph S. Bates** who returns to the presidency of Bates Chemical.

Arthur E. Tempel, Jr. Bio-engineer, microbiological pilot plant, research and development department, Commercial Solvents in Terre Haute, Ind. Formerly with Merck. Studied agronomy and chemical engineering at Iowa State.

OBITUARIES

Jacob D. Jenssen, 74, co-founder of the G. D. Jenssen Co., Watertown, N. Y., died in New York April 16. Mr. Jenssen introduced the reversible two-tower system of sulphite acid making which is used in the majority of the pulp and paper mills throughout the world.

Harold F. Cotter, professor of chemistry at the University of Alabama, formerly chemical engineer at the bureau of tests, International Paper Co., Glens Falls, N. Y., died April 30.

John Loy Blakely, 50, research director, Fibre Products Laboratories, Inc., Newark, N. J., died of a heart attack in New York, May 6. A graduate of Illinois, he formerly worked for U. S. Rubber and Johns-Manville. Since 1945 Blakely has been national president of Kappa Delta Rho.

If your Product is hard-to-pack... *and you need to guard against*

Change in moisture content

Contamination... Sifting

Undesirable odors

Insect infestation

Loss of aroma

Loss from snagging and tearing...

Then you need Bemis Waterproof LAMINATED-TEXTILE Bags

The Strongest Shipping Bags Made

ASK YOUR BEMIS MAN FOR THE COMPLETE WATERPROOF BAG STORY

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MAYBE YOU NEED THESE, TOO

If you don't require the exceptional protection of Bemis Waterproof Bags, Bemis Multiwall, Cotton or Burlap Bags are your best bet.

Whatever kind of bag you need, we make it!

INDUSTRIAL NOTES

NEW LOCATIONS

Consolidated Engineering Corp. has moved to 300 North Sierra Madre Villa, Pasadena, Calif.

Centric Clutch Co. has moved into its newly completed building at the junction of Main St. and Route 35, Woodbridge, N. J.

Leeds & Northrup Co., Philadelphia manufacturers of electrical measuring instruments, automatic controls and heat-treating furnaces, has moved its Boston office to 430 Lexington Ave., Auburndale.

American Institute of Mining and Metallurgical Engineers has moved the office of its petroleum branch to 408 Trinity Universal Bldg., Dallas, Tex.

Alvey Conveyor Mfg. Co. has moved to 9301 Olive Street Rd., St. Louis, Mo.

NEW COMPANIES

Flaccus Personnel Bureau, New York, to specialize in the technical and engineering fields.

Williams Chemical Corp., Indianapolis, to manufacture, purchase, sell and deal in chemical products, materials and commodities and act as sales agents, manufacturers representatives and brokers. William Higburg, associated with Reilly Tar & Chemical Corp. for over 30 years, is president.

Pfizer Canada, Ltd. to handle Canadian sales of the products of Chas Pfizer & Co., Brooklyn, N. Y.

U. S. All Color Wood, Inc., New York, to sell and distribute the basic materials involved in a recently-perfected process for impregnating woods with a variety of standard colors. Raw plywood sheets are permeated with pigments and the sheets are laminated together to form the finished product.

NEW REPRESENTATIVES

Cyclotherm Corp., Oswego, N. Y., has appointed Temperature Equipment Corp. its distributors in the Chicago area.

National Radiator Co., Johnstown, Pa., has appointed Jackson Engineering Co., Los Angeles, sales representative throughout southern California for its heat transfer division.

Graver Water Conditioning Co., manufacturer of equipment for all water-treatment processes, has appointed Flagg, Brackett & Durgin, Inc., Boston, as its New England representative.

Bowser Inc., Terryville, Conn., has appointed Pacific Refrigeration Co., Los Angeles, as sales agents and field engineers for its technical refrigeration division's line of testing, processing and storage equipment. Concor International Corp., Passaic, N. J., has been made exclusive export representative.

Atlas Mineral Products Co., Houston, has appointed Shutt Process Equipment Co. as agents for its chemical resistant materials of construction in the St. Louis territory.

NEW LINES

Detecto Scales, Inc., Brooklyn, N. Y. The industrial scale business of Yale & Towne Mfg. Co. The transaction involved patents, equipment, parts and inventory, but none of the Yale trade marks except "Kron."

Amyx Mfg. Co., West Plains, Mo.—Thermosetting plastic molding compounds made from sawdust and known as Xylite through a licensing agreement with Paterson Plastics and Chemical Co., Mobile, Ala. Amyx is erecting an initial plant of 5-ton-per-day capacity to be in production by September.

Lacy Mfg. Co., Los Angeles and **Keyes Tank & Supply Co.,** Casper, Wyo. Conservation storage tanks through a licensing agreement with Hammond Iron Works of Warren and Bristol, Pa.

%Proportioneers, Inc.%, Providence, R. I.—Control unit for internal combustion engines through the acquisition of Synchro-Master Co.

NEW NAMES

Polymer Corp., Reading, Pa., has turned over sales of all its products (nylon, Teflon, Kel-F rod, strip and tubing and fabricated products) to a separate company, Polymer Corp. of Pennsylvania. This step was necessary because of confusion between the Reading company and a concern of exactly similar name in Sarnia, Ontario.

Standard Stoker Co., Erie, Pa., has changed its name to Read Standard Corp.

NEW FACILITIES

General Tire & Rubber Co., Akron—A chemical division to manufacture and sell chemicals, synthetic rubbers and related products on a large-scale commercial basis. A new $1 million plant with a capacity of from 7-10 million pounds of products a year is expected to be in operation by January 1952. G. S. Schaffel, formerly director of plastic research, will be manager of manufacturing for the new division.

Archer-Daniels-Midland Co.—A new product development pilot plant which can duplicate any operation of the company's commercial plants except the actual crushing of flaxseed and soybeans.

Link-Belt Co., Chicago—An engineering and manufacturing plant for the production of elevating, conveying and processing machinery at Colmar, Pa.

Patterson Foundry & Machine Co., East Liverpool, Ohio—A Baltimore district office headed by Patrick Dolan.

Harbison-Walker Refractories Co.—A $3.5 million silica plant to be built at Downington, near Philadelphia.

Lindberg Engineering Co., Chicago—A direct factory sales office in Atlanta, Ga., for its heat treating furnaces and melting furnaces.

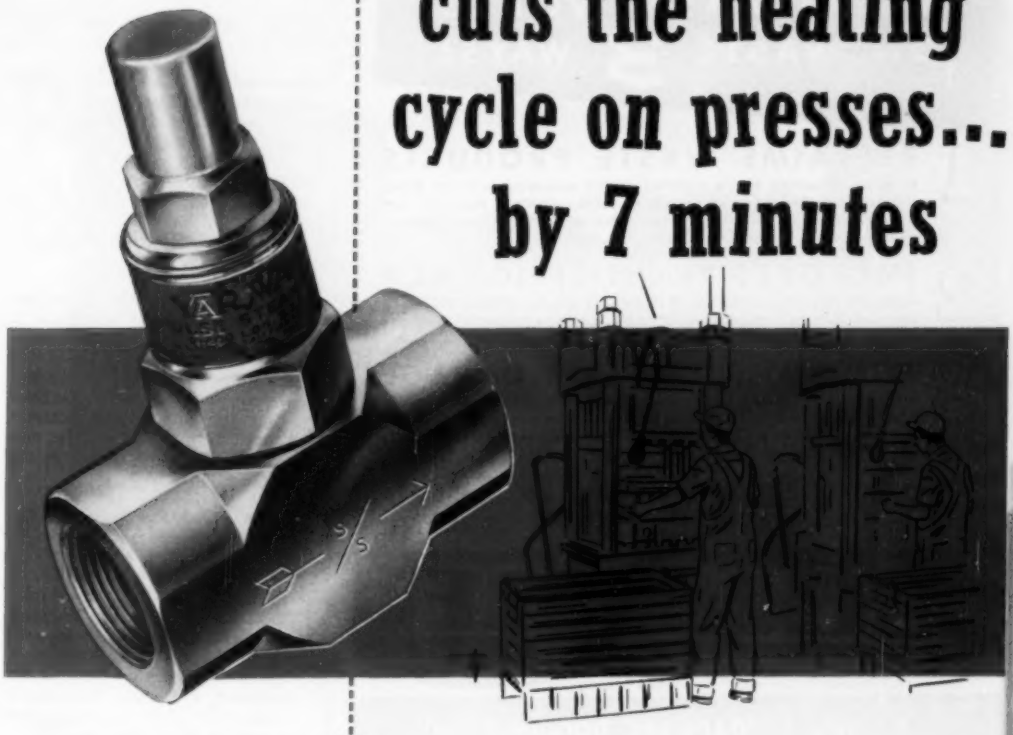
Bristol Laboratories Inc., Syracuse, N. Y.—A new building for its penicillin plant in which tablets, liquids and ointments will be manufactured.

Monsanto Chemical Co.—A market research and product development section for its organic chemicals division. John T. Ragsdale Jr. will be in charge.

Edwal Laboratories, Inc., Ringwood, Ill.—A new unit for production of ammonium thiosulphate crystals. The expansion, completed this month, includes a new building, a

(Continued)

cuts the heating cycle on presses... by 7 minutes



PROBLEM: What to do when production requirements call for a speed-up in the heating cycle.

SOLUTION: (A typical one supplied by a western molded-rubber plant) Equip presses with Yarway Impulse Steam Traps.

RESULT: Heating cycle now 8 minutes instead of their usual 15, a saving of nearly 50%.

Yarway Impulse Steam Traps are designed **to get equipment hotter, sooner, and keep it hot**—thereby increasing production. In operation, Yarways send the most premium B.T.U.'s at top temperatures into your product or process.

Other reasons why over 750,000 Yarways have already been installed are—one moving part, low maintenance, small size, easy installation, good for all pressures, made of stainless steel, low cost.

It's easy to buy Yarway Impulse Steam Traps. One of 216 industrial distributors who stock and sell them is located near you.

FREE! NEW TRAP SELECTOR
The right steam trap in the right place is important. Find quickly and easily which *is* the right Yarway trap for each application in your plant. Write for your free copy of this new 16-page Selector.

YARWAY

the steam trap designed with production in mind

YARNALL-WARING COMPANY • 137 MERMAID AVE., PHILADELPHIA 18, PA.

MULTI-WASH WORKS ON WASTE 3 WAYS!

1 RECLAIMS WASTE PRODUCTS

In many processes where material can be recovered in a wet state, it is possible that many thousands of dollars worth of materials can be reclaimed. A Multi-Wash tower and dewatering tank offers a source of extra revenue from waste products.

2 IMPROVES PLANT EFFICIENCY

Removal of contaminated air will step-up worker efficiency, reduce lost time due to occupational diseases, improve industrial relations and make you a better neighbor in your community.

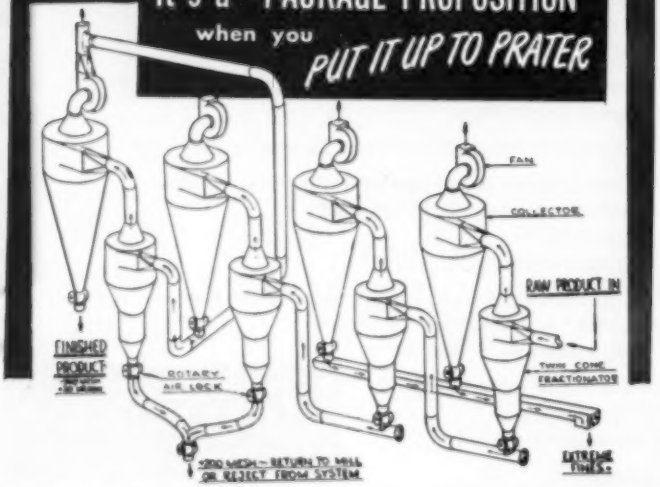
3 ELIMINATES PROPERTY DAMAGE

Airborne dust, fumes and vapors can be dangerous not only to health but property, too. As a protective measure the Multi-Wash system is most essential. Mixing and handling stations are danger points that demand Multi-Wash protection.

CLAUDE B. SCHNEIBLE CO.
P. O. Box 502, Roosevelt Annex
Detroit 32, Michigan

SCHNEIBLE

It's a "PACKAGE PROPOSITION" when you PUT IT UP TO PRATER



PRATER FOUR-STAGE FRACTIONATING SYSTEM

This closed circuit system will grind and fractionate in one continuous operation. It's *all* Prater — Dual Screen Pulverizer (not shown) . . . Twin Cone Fractionators . . . Heavy Duty Collectors . . . and Rotary Air Locks. Fans may be vented to atmosphere or piped to bag filter.

PRATER PRATER PULVERIZER COMPANY
1517 S. 55th Court, Chicago 50, Ill.

INDUSTRIAL NOTES, cont. . .

continuous stainless steel rotary dryer.

Blackman-Uhler Co.–A new textile laboratory at Spartanburg, S. C. The concern is southern representative of Hilton-Davis Chemical Co.

Bemis Bro. Bag. Co., St. Louis, Mo.–A rebuilt and enlarged plant in Seattle, Wash. The original was badly damaged in the earthquake of April 1949.

United States Rubber Co., New York –A branch office and warehouse in New Orleans.

Monsanto Chemical Co.–A substantial expansion of research facilities at its rubber service department plant at Nitro, W. Va. The new building will be completed in the spring of 1952.

Duraloy Co., Scottdale, Pa.–A Detroit sales office headed by W. D. Hazleton.

Heyden Chemical Corp., New York–Regular representation in Washington for its technical development division. Franklin T. Peters, manager of the market development department, will spend two days a week in the capital to provide special service for defense agencies.

Swartwout Co.–Sales office in Detroit for its power plant and industrial ventilating equipment.

Fairbanks-Morse & Co., New York –Philadelphia branch office headed by Robert W. Perry.

Speco, Inc., Cleveland–Eastern district sales office in New York. David M. Waterhouse heads the office.

Catalin Corp. of America–Additional storage facilities for its new liquid resin plant at Calumet City, Ill.

Cornlux Corp., Houston–Expanded capacity which permits annual production of 6 million square feet of shatterproof translucent plastic panels.

Foxboro Co., Foxboro, Mass.–A branch office in Knoxville, Tenn., under the management of Marvin L. Cleaton, Jr.

Zonolite Co., Chicago–Vermiculite processing plants in Trenton, N. J., Birmingham, Ala., and Tampa, Fla.
—*End*

Drums—"Hard to Beat"

The same Continental fibre drums that serve industry so well are giving an equally good accounting of themselves in military service.

Continental drums give extra protection to dangerous, expensive or hard-to-handle articles for shipment anywhere. Their light tare weight cuts shipping costs. They load compactly and ride safely. The closures are tight and strong, but easy to open and close.

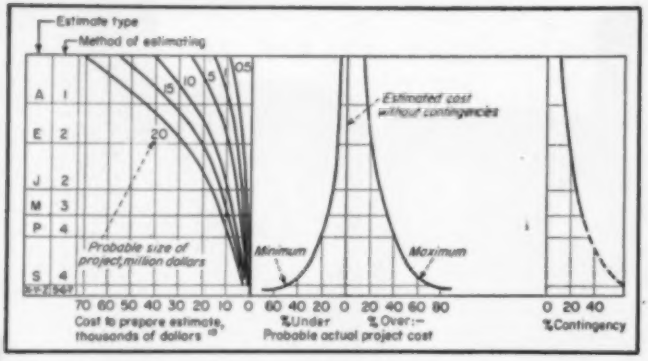
In addition to being rugged and durable, these drums can't be beat for appearance. They are neat and trim and feature quality printing or spray painting.

1. The famous Continental LEVERPAK drum with its unique lever-locking device gives maximum protection under hard usage. 12- to 75-gallon sizes.
2. Continental FIBERPAK drum...a rigid, all-fibre container in ¾- to 67-gallon sizes.
3. Continental STAPAK drum. Has fibre body with metal top and bottom. Supplied in 2- to 35-gallon sizes.
4. Continental UPAK drum. Custom-made for the shipment of rolled materials.

CONTINENTAL CAN COMPANY

FIBRE DRUM DIVISION — VAN WERT, OHIO

NEW YORK • PHILADELPHIA • PITTSBURGH • TONAWANDA • CLEVELAND
CHICAGO • SAN FRANCISCO • ST. LOUIS • LOS ANGELES • EAU CLAIRE



Estimating cost? How accurate?

ESTIMATE TYPES	A	E	J	M	P	S	X	Y	Z
Information available									
General design basis[1]	x	x	x	x	x	x	x	x	x
Flowsheet and material balance	x	x	x	x	x	x	x	x	
Heat and energy balance	x	x	x	x	x	x	x		
Equipment and instrument list[2]	x	x	x	x	x	x			
Performance data sheets	x	x	x	x	x	x			
Survey of plant area[3]	x	x							
Availability of utilities and transportation[4]	x	x							
Information developed by engineers and designers									
Design sketches[5]	x	x	x	x	x	x			
Layout of mfg. facilities[6]	x	x	x	x	x				
Layout of non-mfg. facilities[7]	x	x	x	x					
General plant layout & land development	x	x	x	x					
Type of construction	x	x	x						
Schedule of pipelines[8]	x	x	x						
Piping layout[9]	x	x	x						
Elec. layout and one line diagram	x	x	x						
Detailed piping and instrument flowsheets	x	x							
Instrument specifications	x								
Electrical control and interlocks	x								
Soil bearing values	x								
Architectural and structural design (approx.)	x								

Estimate cost depends on data you must develop.

Next Time, Give the Boss a PRECISE Capital Cost Estimate

Suppose the boss's boss asks you for a close estimate of the capital required for a new process. You'll want to keep the charts* above, or make larger copies of them so that you can give him the right answer.

W. T. Nichols

Assume that Mr. Executive asks you what is the best kind of an estimate you can make on a certain project. How do you reply? You might give him a "blue sky" estimate, a "horseback" estimate, or an "armchair" estimate. Because these are very general terms; there is often no really quantitative understanding between engineers

(*Continued*)

* For a complete set of footnotes, see next page.

Choose from these methods.

METHOD 1 (Estimate Type *A*)

Quoted equipment cost (delivered)	$0,000
Estimated installation cost for each item of equipment	0,000
Material cost take-offs for pipe, electrical, architectural, structural, instruments, etc.	0,000
Labor estimated from practice factors for items above	0,000
Subtotal	$00,000
Engineering & contingency (% subtotal)	0,000
Total	$00,000

METHOD 2 (Estimate Types *E*, *J*)

Installed cost equipment = delivered cost (quoted and estimated) ÷ 0.70	$0,000
Buildings, pipe, sewers, electrical, instruments, structural, foundations, insulation, painting, etc., based on unit cost per item, length, area, or volume from preliminary design and take-off	000
Subtotal	$00,000
E & C (% subtotal)	0,000
Total	$00,000

METHOD 3 (Estimate Type *M*)

Equipment cost from established data	$0,000
Equipment installation, buildings, pipe, sewers, electrical, instruments, structural, foundations, insulation, painting, etc., based on % of equipment cost using experience factors	000
Subtotal	$00,000
E & C (% subtotal)	0,000
Total	$00,000

METHOD 4 (Estimate Types *P*, *S*)

Capital cost = factor × total delivered cost of equipment determined by quotations on unusual items, and with other items from established or published data.

Factors:
- 3.10 for solids process plant.
- 3.63 for solid-fluid plant.
- 4.74 for fluid plant.

METHOD 5 (Estimate Type *X*)

Capital cost = factor × total delivered cost of equipment determined by established or published data. (Factors same as 4.)

METHOD 6 (Estimate Types *X*, *Y*)

Capital cost estimated on basis of $ per ton/year from published figures × factor to bring up to date.

METHOD 7 (Estimate Type *Z*)

Capital cost = factor × annual capital × unit price.

TOO "HOT" FOR ORDINARY HANDS!

When materials are too "hot" to handle, Greer solves the problem with "mechanical hands" remotely controlled by an operator far enough away for absolute protection.

These remarkably ingenious devices rival the versatility of the human hand. Objects weighing up to 250 lbs. are moved up, down, sideways, and are pin-pointed on any working area. It is a simple matter, for instance, to pour liquids from container to container.

Many less dramatic but equally important materials-handling and similar problems have been solved – or are being solved – by Greer Research and Development engineers. With many years of work in the field, these men offer you specialized knowledge and abilities which are difficult to find elsewhere.

If you are concerned with any phase of materials handling, you are invited to bring your problems to Greer. Here you will find *creative engineering* at its best – the kind that is accustomed to meeting and solving the "impossible". An inquiry on your company letterhead will receive prompt attention.

GREER
RESEARCH & DEVELOPMENT

GREER HYDRAULICS INC. • 454 EIGHTEENTH STREET • BROOKLYN 15, NEW YORK

QED, *cont. . .*

who produce estimates and the people who require them.

A long step away from this difficulty and in the direction of better understanding of capital cost estimation has recently been taken by engineers† at the Monsanto Chemical Co. The ingenuity of these men has led to the following system, summed up in the graph on the preceding page.

There are, literally, an infinite number of ways to estimate. We have chosen a certain set of seven methods to illustrate a gradation from complex to simple. It is likely that the same methods will be of interest to anyone in chemical manufacturing, though variations will result from personal preferences or experience. The seven methods are shown on page 248.

Various grades of estimates can result from the use of one or the other of these methods of estimating along with more or less of the data stated to be required. If we have all the data needed, and use the very best, most elaborate method, the highest grade of estimate may be obtained. If we have no data except the general design basis, then we can obtain only the poorest sort of capital cost estimate, by using the simplest, least elaborate of the methods outlined.

We have chosen to use letters of the alphabet to designate the various sorts of estimates, the letter indicating our opinion of the relative quality of the estimate. We use A to denote the highest grade, Z the lowest and other letters in proportion. Chart shows just what enters into each type of estimate. For an A-type estimate, every block in the chart contains an X to signify that every kind of information listed is employed, and furthermore, we use estimating method No. 1. In an *E*-type estimate, we get along without instrument specifications, electrical controls and interlocks, soil bearing values and architectural and structural design. We use estimating method No. 2.

For a *J*-type estimate, we do not require a survey (including land values and developments), or the details of utilities and transportation (including laboratory and service facilities required). In addition to the estimate items omitted from the *E*-type study, we drop also the detailed piping and instrument flowsheets. We still use estimating method No. 2, however.

Other types are still simpler, right down to Z-grade. Every time we simplify the estimate, we reduce the cost of obtaining it. The first illustration shows the relationship between the cost to prepare the estimate and the probable size of the project, based upon certain data available to us. A number of correlations made by others tend to confirm this relationship.

If an estimate is well and truly made, the actual cost of the job may run from a figure well under the net estimate to one well above, depending upon whether the job got all the breaks or all the bumps. The graph also indicates the variance which we believe can apply to the various types of estimates. It will be noted that for the best example of a Type A estimate, getting all the breaks may make the job under-run the net estimate by about 5 percent, while getting all the bumps may throw the cost about 15 percent above the line. The precision decreases greatly as the quality of the estimate changes until it is very poor indeed for the *X-Y-Z* types.

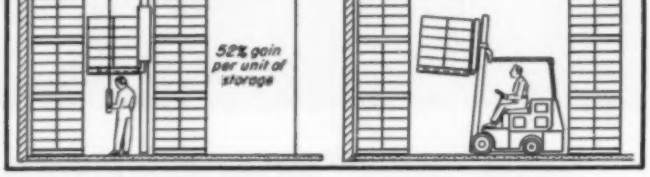
The graph also illustrates a suggested curve for contingency allowances to be added to the net estimated cost to secure the amount required to be appropriated. It will be noted that part of the line is broken to denote the area which we believe is of more interest for approximate evaluations than for appropriation requests.

W. T. Nichols, Monsanto Chemical Co., before the American Chemical Soc., Cleveland, April 9, 1951.

† System described was developed by Edwin H. Buford, Milton Welhoelter, and Robert B. Wright, General Engineering Department, Monsanto Chemical Co. It was described in detail in an engineering report of that company.

NOTES FOR ESTIMATE TYPES CHART

[1] (a) Product to be made, specifications and storage provisions; (b) plant capacity; (c) operating stream time; (d) provisions for expansion; (e) raw materials, source and storage. [2] Showing number of each item required, capacity and materials of construction. [3] Land values and land developments. [4] Description of lab. and service facilities required. [5] Unusual items of equipment. [6] Showing equipment in plan and elevation. [7] Utilities and service facilities, roads, sewers, etc. [8] Sizes, materials of construction. [9] Superimposed on equipment and plan layout. [10] Cost for preparing estimates contemplates no alternate studies and will not result in any construction drawings or specifications. Does not include cost of preparing the information available of the cost of sub soil investigations to determine soil bearing values.



SPACE SAVING in aisle widths—52 percent per unit of storage. That's why . . .

Now, a Fork-Lift *Crane*

Fred A. Miller

The so-called "stacker crane," developed by Du Pont, is an entirely new facility for materials handling. It is called a stacker crane because the stacking feature of the fork truck has simply been attached to the trolley of an overhead bridge crane. It was developed to maintain maximum storage capacity and, at the same time, to achieve the economies made possible by the fork truck and pallet system.

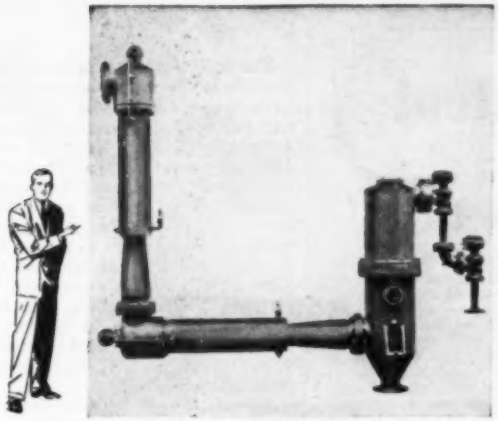
Realizing the need for new equipment to do this job, the Du Pont Engineering Department devised and developed this scheme because no other type of available handling equipment studied would reduce this sacrifice of storage capacity. It was desired to develop a new method which would retain the same inventories as obtained with hand stacking, or increase them.

An overhead-supported rigid mast was devised (see cut), with a pick-up to improve space utilization over that of the fork truck system by reducing aisle widths required. The mast is attached to the trolley of a conventional overhead bridge crane. The rigid mast is secured to a turntable built into the bed of the trolley. A hoisting carriage with any type load-engaging device completes the development.

In effect, the basic fork truck elements have been taken and suspended from the ceiling, eliminating the counterweight in the process.

Note in the cut that the blank portion shown denotes a 52 percent savings in the space required for the stacker crane as compared with the fork truck. For one-column deep pattern, the storage space ratio is of the order of 9 to 13.65.

(Continued)



HIGH VACUUM?

Four-stage Worthington condensing ejector is typical of four- and five-stage units for vacuum drying and distillation processes below 1 mm Hg abs.

INTERMEDIATE VACUUM?

Three-stage Worthington condensing unit is for intermediate vacuum applications in the range from 10 mm to 1 mm Hg abs.

WHICH PICTURE

solves your vacuum problem?

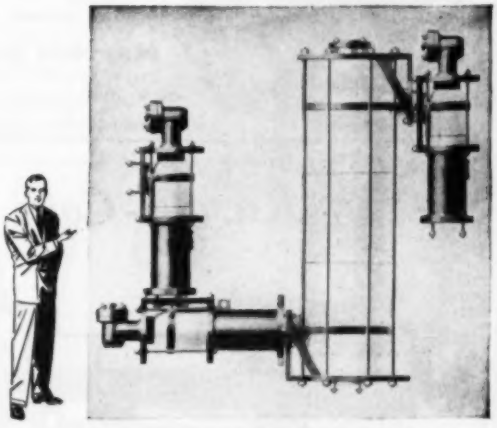
This is the *really complete* steam-jet ejector line —Worthington.

A model for every vacuum requirement—from atmospheric to 50 microns absolute. Single and multiple stages. Condensing and non-condensing.

Constructions in any material you need to resist corrosive vapors—stainless-steel, bronze, porcelain and impervious graphite—as well as cast-iron and steel.

Experience in this field reaching back to 1918 and a fund of estimating data are available to consulting engineers and end users.

For distillation, drying and other purposes, get the most out of vacuum with Worthington Steam-Jet Ejectors. *There's more worth in Worthington.* Worthington Pump and Machinery Corporation, Steam Power Division, Ejector Section, Harrison, New Jersey.

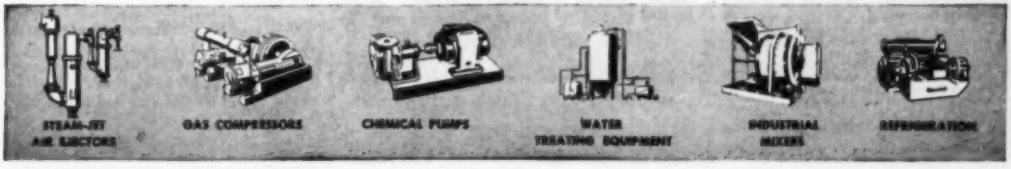


SPECIAL MATERIALS?

This Worthington unit is made of special acid-resisting material for handling highly corrosive vapors. Available in many anti-corrosive materials.

WORTHINGTON

X1.1



Moisture Content Revealed !

This fully portable Marconi meter immediately reveals the true moisture content of a wide range of materials. Its operation, although giving half per cent or better accuracy, is simplicity itself with no weighing or calculation. The compression test cell is designed for uniform results and elimination of packing errors and the electronic circuits are stabilised against tube or line variations. Why not use this meter in your plant or mill and take advantage of modern industrial electronics.

• *Range from below air-dry to near saturation.* • *Covers paper and wood pulp, cotton, tobacco, flour, grain and seeds and many foodstuffs.* • *Alternative electrodes for different applications.* • *A.C. line or battery operated.*

THE MARCONI MOISTURE METER

Marconi Instruments

23-25, BEAVER STREET, NEW YORK 4

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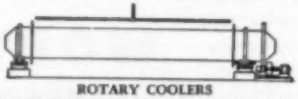

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For cooling hot materials after high temperature drying or calcination. Available in three types: air cooled, water spray cooled, and semi-submerged. From 5' to 15' in diameter, shell lengths to suit.

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QED, cont. . .

The fork truck and pallet system generally is accepted as the most economical means for storing raw materials and finished products. However, a standard 4,000-lb-capacity truck with 18-in. sq. pallets requires a 12 to 13-ft.-wide operating aisle width, whereas manual stacking requires a 5-to-6-ft. aisle width. Consequently, storage capacity is reduced 10 to 15 percent by the use of the fork truck. Increased investment cost also is experienced in planning new storage areas, since the additional aisle space for fork truck operations must be provided at the prevailing cost of 75c. to $1 per cu. ft. for building construction.

To date, 14 stacker crane installations are in operation or will be completed in the next few months.

Fred A. Miller, E. I. du Pont de Nemours & Co., before the third biennial Materials Handling Conference, Buffalo, Oct. 24, 1950.

FLOTATION PROCESSES

. . . *For Waste Water*

Nicholas A. D'Arcy, Jr.

Disposal of industrial waste water is constantly presenting more difficult problems. Anti-pollution boards, fish and game commissions, harbor boards, and many other commissions are establishing stringent requirements regarding oil content, suspended-solids content, biochemical oxygen demand (BOD), hydrogen sulphide generating capacity, and pH of industrial waste waters. Scarcity of water in many localities makes it necessary for large industrial water consumers to treat their waste water for re-use in the process. The conventional gravity separators are difficult to built and operate in compliance with modern regulations or efficient water re-use programs.

Properly designed and operated dissolved-air flotation clarification has been effective in removing free oil from waste water. When colloid-forming chemicals are added, the colloidal

(*Continued*)

SLIDE RULE COMBINATION TO PEARLY GATES?

"We hear such dubious terms as "human engineering." Drummers like to be called "sales engineers." Plumbers are "sanitary engineers." For all I know the clergy may aspire to be "theological engineers."

RALPH PRESCRAVE, *Vice President, J. D. Woods & Gordon, Ltd.*

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You get extra protection from these rugged, all wood carboy boxes due to their sturdy, patented construction . . . with interchangeable cork (Hercules) or rubber cushion (Aero) inserts and cushions. That's why they stand up under the rough-and-tumble of regular usage and save you both time and money by reducing bottle breakage, repairs and replacements. For the best carboy boxes possible . . . contact National!

6½-GALLON CARBOY FEATURES

Built to withstand an internal pressure of 10 lbs. this completely enclosed wooden carboy, with interchangeable cork or rubber cushion inserts and cushions, complies with I.C.C. 1-D regulations for the transportation of mineral acids. Specific application should be made for other uses.

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2. Corner posts provide a convenient handle so that one man can handle the carboy.
3. Small size and light weight provides for easier handling and shipping.
4. Regulation Polystyrene cap supplied.

Complies with classification I.C.C. 1-D

13-GALLON CARBOY FEATURES

1. All-point protection reduces bottle breakage to a minimum—both in loading and transit.
2. Reduces occupational hazards since safety from breakage minimizes danger of acid burns or fire.
3. Eliminates foreign filler materials from container.
4. Easy to handle, through good grip on side hand braces.
5. Compact loading, resulting in space saving storage.
6. No skilled labor or special tools required. Any man can handle it quickly and efficiently.
7. Also available in 5 gallon and other capacities.

Complies with classification I.C.C. 1-A

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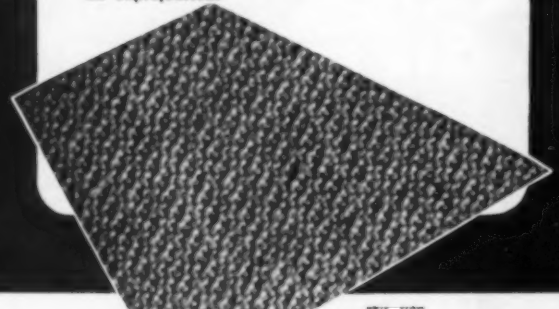
In order to properly service such operations, we maintain an adequate variety of cotton filter media in numerous different weaves and weights. Without obligation we will be glad to submit recommendations to you if you will describe your operating conditions to us. As our products comprise all types of woven industrial filter media both natural and synthetic, our selection is certain to be unprejudiced.



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DOWN, BUT NOT OUT

"It isn't falling into the water that drowns a man; it's staying there."
Cominco Magazine

QED, *cont. . .*

floc aided by dissolved-air flotation will often produce a waste-effluent content less than 25 ppm. total emulsified and free oil and less than 100 ppm. suspended solids, and will generally produce an effluent with a substantial reduction in BOD and hydrogen sulphide generating capacity. Some of the important considerations in the selection and design of a dissolved-air flotation or colloid-air flotation system are:

1. Dissolving the maximum amount of air in the influent.
2. Elimination of all entrained air, as the release of entrained air in the flotation chamber introduces turbulence and short circuiting.
3. Proper hydrodynamic design of the entire flotation system, especially the flotation chamber.
4. Selection of the proper coagulant and floc-forming chemicals, if they are required—always bearing in mind that the most economical, as well as the most efficient chemicals should be used.
5. Continuous mechanical removal of oil or floc from the surface of the water in the flotation chamber.
6. Design of the entire system to produce a unit which will operate automatically under a wide range of conditions and which requires a minimum amount of trained personnel for its operation.

Dissolved-air flotation and colloid-air flotation have efficiently cleaned up industrial waste waters from paper manufacturing plants, oil refineries, oil-field brine, meat packing plants, fish canneries, soap-manufacturing plants, and many other miscellaneous applications.

The cost of chemicals in colloid-air treatment ranges from approximately $1 to $10 per thousand barrels of effluent treated, and the cost of equipment capable of treating 1,000 gpm. of water is approximately $25,000 plus installation costs. The high efficiency of dissolved-air flotation and colloid-air flotation makes it possible to handle efficiently large volumes of air in a relatively small machine. A dissolved air flotation unit capable of treating 1,000 gpm. can be installed on a flat concrete slab approximately 16 ft. wide by 45 ft. long.

Properly designed dissolved-aid flotation or colloid-air flotation units are semi-automatic in their operation.

They require daily checking for lubrication, as well as occasional attention for chemical mixing. Units in operation require from 1 to 3-hr. attention per 24-hr. day.

Before any flotation unit is installed, careful laboratory tests must be made upon the waste water to be treated in order to determine its particular characteristics and adaptability to this type of treatment.

Nicholas A. D'Arcy, Jr., consulting mechanical engineer, before the American Petroleum Inst., Tulsa, May 1, 1951.

STRATEGIC METALS

. . . *From Wastes*

Strategic metals from former wastes are helping to meet wartime demands. Several new processes yield valuable materials from mining residues, flue dusts, soot deposits, and process liquors. Often exploitation can turn a marginal source of metal into an economic producer, and many rare metals can be extracted from wastes, even though recovery directly from the ore would be impractical.

The Union of South Africa has recently agreed to sell to the United States and Great Britain, the entire output of uranium recovered from gold ores. Almost all of the gold ores of the region show small percentages of uranium compounds. Four recovery plants are planned, and production is expected to begin in about 2½ years. Both old waste dumps and fresh ores will be treated.

During the last war, many of the huge slag dumps that accumulated around steel mills were combed for the masses of iron that sometimes escape when the molten slag is run off. One company recovered 150,000 tons of scrap iron in one year from such an operation. Dumps of iron ore, discarded in the days when only the highest-grade ores were shipped, are now being beneficiated by various means to increase the iron content. The Bureau of Mines is carrying on a program now in the pilot plant stage, to reclaim manganese from slag. An estimated 300,000 tons of manganese may be recovered annually, with a reduction of almost half our ore imports. Another process for recovering man-

(*Continued*)

GETTING AHEAD, OR A HEADACHE?

"Most men feel they would be a success in business if they had the money to go out and buy themselves a monopoly."

—DePere Journal-American reprinted in Partners

1901-1951

50th Anniversary

Today, more than ever, you can look to

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QED, *cont. . .*

ganese from low-grade domestic ores has recently been announced.

This rise of the flotation processes has caused re-examination of many dumps left by less efficient processes. During World War II, large accumulations of fluorite "tailings" and waste rock were treated in this fashion, with more than 90 percent of the fluorite recovered. A somewhat older application of the techniques has been used in reclaiming cobalt, tungsten, and chromium from grinding-wheel sludges. Lead, zinc, tin, and gold, have also been recovered by flotation.

Slag fuming is also used to recover lead and zinc from waste piles. The desired metal is boiled up or "fumed" from the surface of a furnace-load of molten slag. The vapor is then converted to metallic-oxides and cooled to a solid or a powder for further processing into finished metal. There are three such installations in North America now; the latest is for an 800,000-ton accumulation of residue estimated to contain 26 percent zinc.

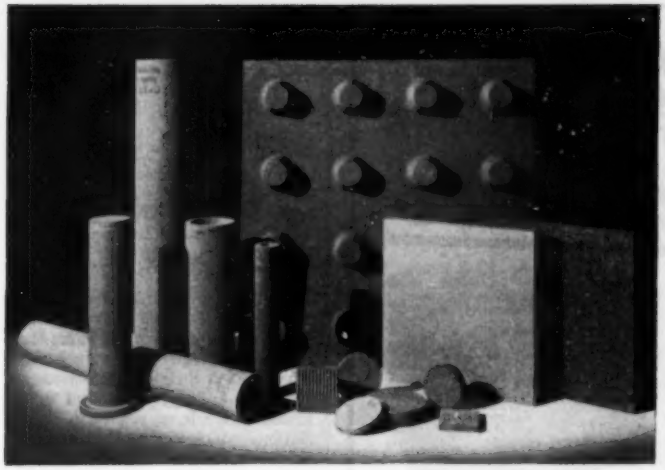
CONCENTRATES FROM ROASTING

Roasting of ore concentrates containing traces of the desired metal can result in concentrates thousands of times richer than the starting material. The richest source of rhenium is molybdenite ore, which contains from 0.6 to 0.7 percent molybdenum and only 0.0001 to 0.05 percent rhenium. The flue dusts from roasting contain up to several percent of rhenium, and are the present source of supply. Rhenium is similar to tungsten and may be substituted for it in many applications.

Geranium is similarly obtained, mainly as a byproduct from smelters handling zinc ores containing traces of the element. It is expected that flue dusts and ashes resulting from the burning of coal containing Geranium will in time become the most important source. Geranium is used increasingly in the electronics industry in producing ultra-high frequency or microwave currents, and in the new transistors which perform many of the functions of conventional vacuum tubes.

Flue dust was an important source of cadmium during the last war, but these reserves have been exhausted, and cadmium is now obtained primarily as a byproduct from the refining of cadmium-bearing zinc or lead ores. For many years, a minor source of vanadium has been flue deposits obtained from burning oils, such as those from Venezuela, containing traces of the metal. Boiler scale from

(Continued)



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Norton, long-experienced in the development of fused alumina products, meets this need with porous mediums of ALUNDUM material. Thanks to "controlled structure" processing, all Norton ALUNDUM porous mediums have substantially the same pore volume — while the size and number of open pores are varied to provide the desired permeability.

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ALUNDUM porous mediums are unaffected by acid, neutral or slightly alkaline conditions encountered in commercial and laboratory processes . . . they are exceedingly refractory, withstanding temperatures up to 1000° C . . . their unusual strength assures maximum resistance to abrasion, high operating pressures and breakage or chipping in handling.

Send For Bulletin

Bulletin No. 140 contains complete data as to physical structure, etc., of Norton ALUNDUM porous mediums, and other refractory products. Let it help you decide whether they will benefit your processing. Your Norton representative will be glad to supply you with a copy, or write direct. Norton Company, 506 New Bond St., Worcester 6, Mass.

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Norton Company is now making catalyst supports in commercial quantities, in five different mixtures of refractory grains, ranging from 77% to 89% fused alumina. Water absorption values of these catalyst supports vary from 12% to 22% by weight, while surface areas by the nitrogen absorption method range from 0.025 to 0.821 square meters per gram. They are made in spheres, pellets and rings of varying sizes.

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DESIGNERS—MANUFACTURERS—ERECTORS BULK MATERIAL HANDLING SYSTEMS

ships burning Venezuelan crudes also contains usable amounts of the metal, which is sometimes recoverable.

From the Industrial Bulletin of Arthur D. Little, Inc.

LAWS OF CHANCE

. . . *Assist Researchers*

A new mathematical technique is now helping research workers predict the outcome of situations where large numbers of individual particles are influenced in their behavior partly by chance and partly by known or assumed methods or sequences of operations which serve as a model of the real situation. The name is appropriate in that the sequence of these known events is selected in a random way. If, on first trial, the model does not agree with the actual known facts, the factors influencing the operation can be changed to make the model more accurate. Then, with the model perfected, the factors can be changed deliberately to see how a change in the situation will affect its outcome. Such problems can often be handled by conventional mathematics or by experimentation, but frequently the situations are too complex for usual mathematical techniques and experimentation is too expensive or too dangerous.

To keep track of the extensive data and allow rapid performance of the operations, punched cards are often used to represent each individual, whether it be a molecule in a gas, a neutron in an atomic pile, or an account of a large business. These cards then "move" just as the actual particles might, but the moving involves mechanical shuffling and sorting of the cards, with the new "positions" indicated by information punched automatically into the cards. At the end of the process the cards give a picture of where the actual particle would be located. The nature and extent of each move, within the boundaries of the system are determined by random numbers punched on another set of cards, with the randomness modified by the known conditions of the situation.

Both the scientist and the business man must often deal with large numbers of individual units, each acting in a random fashion, but with the whole group subject to general laws. Study of the properties of complex chemical compounds is one interesting application of the method. The molecules of many plastics are long chains

of thousands of atoms and groups of atoms, and these individual groups can take many positions. The form and variety of their arrangement strongly influences the physical characteristics of the plastic. Often it is more expedient to forecast the outcome of change in the arrangement by the Monte Carlo method than by actual synthesis. In the business field, behavior of the accounts of a large organization can be studied by the Monte Carlo method, with the control cards set up to show the influence of such factors as advertising, credit arrangements, and other sales policies. By changing factors on the cards, decisions can be reached without expensive test campaigns.

From the Industrial Bulletin of Arthur D. Little, Inc.

RHENIUM

. . . *In High Temperature Alloys*

A. D. Melaven

A rare metal which up to now has been little more than a laboratory curiosity, may soon find important applications in the fields of electronics and high temperature alloys.

The metal is rhenium, and it is said to be the heaviest substance known. It is similar in some respects to manganese and tungsten, has as high a melting point as tungsten, and has a higher electron emission—a property which makes it extremely valuable to manufacturers of high vacuum electronic equipment. Rhenium also has a longer life than tungsten when operated at any given temperature.

As an indication of rhenium's growing importance, sales of the metal and its compounds already include shipments to 66 research laboratories, 42 colleges and universities, and 8 dealers in rare chemicals in this country as well as to foreign countries.

Discovered in 1925 by workers in Germany, rhenium was produced commercially about 1930 from a Norwegian ore. Shipments stopped when World War II began, and production has never been resumed from the Norwegian source.

Last quoted price on the foreign material was $4,500 a lb.

A domestic source of the rare metal was discovered in the early 1940's in a flue dust obtained in the processing of molybdenum sulphide, a byproduct of Arizona copper sulphide ore.

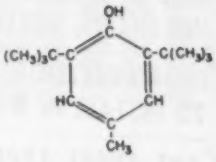
The metal prepared by a process developed at the University of Tennessee, is a dark gray to black powder

(Continued)

KOPPERS **DBPC**

DI-tert-BUTYL-para-CRESOL

is a highly-effective antioxidant

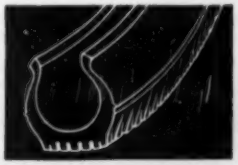


● Koppers 2,6 Di-tert-butyl-para-cresol (DBPC) is a crystalline, tri-alkylated phenol, easily soluble in common organic solvents. Being a hindered phenol, it undergoes few of the reactions typical of unhindered phenols, such as phenol and meta-cresol.

Koppers DBPC is an oxidation inhibitor that is non-staining and non-corrosive; it is insoluble in aqueous solutions of acids or alkalis. For the rubber, petroleum and insecticide industries, DBPC has proved its value as a highly-effective antioxidant.

FOR FURTHER INFORMATION, write for your copy of Bulletin C-9-115. It describes in detail the properties, reactions and uses of DBPC.

for these industries



RUBBER DBPC is useful as a "non-coloring" and a "non-staining" rubber anti-oxidant, because it causes little or no discoloration of white or light-colored rubber products, even after prolonged exposure to light, heat and air.

INSECTICIDE DBPC is especially effective in the prevention of oxidation and deterioration of insecticide compositions containing pyrethrin. Pyrethrin has a marked tendency to decompose on exposure to light or air; such decomposition results in a marked decrease in the insecticidal value of the product. DBPC inhibits these oxidation processes, thus prolonging potency of the insecticide.

PETROLEUM DBPC is an excellent antioxidant for high-grade lubricating oils for low-temperature service such as spindle oils, gun greases, waxes, etc., and for such oils as turbine oils and transformer oils. In these oils, it inhibits the formation of gums and acidic products which are formed due to oxidation.

It is also one of the most effective inhibitors for the reduction of gum formation in aviation gasolines, where it is important to effect the inhibition without the production of undesirable deposits of residues in carburetors.

Though supplies are at present limited by the emergency demand, many known possibilities of DBPC make it a most interesting chemical for further study in your laboratories.

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QED, cont. . .

selling at approximately $900 per lb. The price still remains high because of the scarcity of rhenium and the low production capacity of the present facilities.

Although it corrodes appreciably in moist air, rhenium metal is resistant to non-oxidizing acids and because of this and its high melting point, it is likely to find its most important applications in high vacuum electronics.

A. D. Melaven, University of Tennessee, before the American Chemical Soc., Memphis, May 4, 1951.

WATER POLLUTERS

. . . May Be Utilized

D. F. Othmer, M. D. Weiss,

R. S. Aries

The increasing severity of the water pollution control enforcement problem program and the decreasing amount of fresh water available to industry has led to the search for new methods of utilization of the materials which ordinarily would be discharged as a pollutive waste. The method of utilization of a waste material is economically the most satisfactory but technically the most difficult, calling upon the best skills of chemist, chemical engineer, mechanical engineer, and marketing expert.

Each industry has developed a utilization program along its own lines. In the food industries, packing-house wastes have been converted to valuable rare organic chemicals, dairy plant wastes to new food products. Valuable growth factors have been discovered in the former wastes of the fermentation industries which are now being utilized as stock feed. Wastes from the petroleum industry are utilized as fuel and in fertilizer manufacture, from the blast furnace in fertilizers, from metal plating as a source of inorganic chemicals. Synthetic tanning materials have been made from the wastes of the naphtha industry. The pulp and paper industry as the culmination of a long research program seeking utilization of the wastes of the sulphite pulping process has developed products ranging from roadbinders to synthetic vanillin.

Mobilization of the resources now discarded as pollutive wastes will go a long way toward solving the industrial water pollution problem.

D. F. Othmer, M. D. Weiss, and R. S. Aries, Brooklyn Polytechnic Inst., before the American Society of Mechanical Engineers, Baltimore, Mar. 28, 1951.

—*End*

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CUT TRIAL-AND-ERROR

(*Continued from page 114*)

For pipes in series a material balance gives

$$Q_1 = Q_2 = Q_3 = Q_n = Q_T \quad (17)$$

For circular pipes,

$$D_1^2 u_1 = D_2^2 u_2 = D_3^2 u_3 = D_n^2 u_n \quad (18)$$

Using u_1 as the reference velocity

$$u_2 = u_1\left(\frac{D_1}{D_2}\right)^2, \; u_3 = u_1\left(\frac{D_1}{D_3}\right)^2, \; u_n = u_1\left(\frac{D_1}{D_n}\right)^2 \quad (19)$$

For a series system,

$$\Delta F_T = (\Delta F_1 + \Delta F_2 + \Delta F_3 + \Delta F_n) \quad (20)$$

Substituting for the ΔP terms by means of Eqs. (2) and (3) the following expression is obtained:

$$\Delta F_T = \left(\frac{0.08}{g}\right)\left(\frac{\mu}{\rho}\right)^{0.2}\left[\frac{N_1 u_1^{1.8}}{D_1^{1.2}} + \frac{N_2 u_2^{1.8}}{D_2^{1.2}} + \frac{N_3 u_3^{1.8}}{D_3^{1.2}} + \frac{N_n u_n^{1.8}}{D_n^{1.2}}\right] \quad (21)$$

Substituting for the velocities in Eq. (21) by means of Eq. (19) one obtains

$$\Delta F_T = \left(\frac{0.08}{g}\right)\left(\frac{\mu}{\rho}\right)^{0.2}\left(u_1^{1.8}\right)\left(D_1^{4.8}\right)\left[\Sigma\left(\frac{N}{D^{4.8}}\right)\right] \quad (22)$$

Therefore

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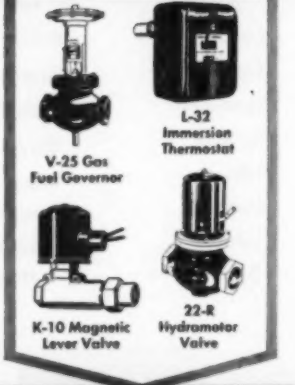

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$$a_n = \left(\frac{4}{\pi D_n^2}\right)^{1.852} \frac{(20.4)(\Delta F_T)^{1.852}}{\left[\Sigma\left(\frac{N}{D^{4.84}}\right)\right]^{1.852}} \left(\frac{\rho}{\mu}\right)^{0.0869} \quad (23)$$

and

$$Q_n = Q_T = \frac{20.4(\Delta F_T)^{1.852}}{\left[\Sigma\left(\frac{N}{D^{4.84}}\right)\right]^{1.852}} \left(\frac{\rho}{\mu}\right)^{0.0869} \quad (24)$$

Letting $\psi = \left(\frac{N}{D^{4.84}}\right)$

then

$$Q_T = 20.4 \left[\frac{\Delta F_T}{\Sigma(\psi)}\right]^{1.852} \left(\frac{\rho}{\mu}\right)^{0.0869} \quad (25)$$

ANALOGY TO ELECTRIC CIRCUITS

Let the parameter ψ be termed the physical resistance of a pipeline to a flowing fluid. Then the parameter a becomes the conductance parameter of the pipeline by the simple ratios below:

$$a = \left(\frac{D^{4.852}}{N^{1.852}}\right) = \left(\frac{D^{4.84}}{N}\right)^{1.852} = \left(\frac{1}{\psi}\right)^{1.852}$$

Thus for series pipelines, the total resistance ψ^T may be found from:

$$\psi_T = \Sigma(\psi) = (\psi_1 + \psi_2 + \psi_3 + \psi_n)$$

For pipes in parallel, the total resistance:

$$\left(\frac{1}{\psi_T}\right)^{1.852} = \left[\left(\frac{1}{\psi_1}\right)^{1.852} + \left(\frac{1}{\psi_2}\right)^{1.852} + \left(\frac{1}{\psi_3}\right)^{1.852} + \left(\frac{1}{\psi_n}\right)^{1.852}\right]$$

The total conductance may be found from the summation:

$$a_T = \Sigma(a) = (a_1 + a_2 + a_3 + a_n)$$

For parallel and series combinations the total resistance may be found from:

$$\left(\frac{1}{\psi_T}\right)^{1.852} = \left(\frac{1}{\psi_1 + \psi_2 + \cdots \psi_n}\right)_I^{1.852} + \left(\frac{1}{\psi_A + \psi_B + \cdots \psi_Z}\right)_{II}^{1.852} + \left(\frac{1}{\psi_\beta + \psi_\gamma + \cdots \psi_\omega}\right)_N^{1.852}$$

The parallel pipelines are designated by I, II, and N, while the series lines in each respective parallel branch are denoted by 1, 2, and n; A, B, and Z; β, γ, and ω.

This value of ψ may be substituted for $\Sigma(\psi)$ in Eq. (25) so that if the kinematic viscosity and either ΔF_T or Q_T are known, the other can be determined.

PARALLEL AND SERIES COMBINATIONS

Given: The over-all pressure drop between A and B, (Fig. 3) the lengths and diameters of the pipelines, and the kinematic viscosity of the fluid flowing. Find: The total volumetric rate of flow, Q_T.

From Eq. (25),

$$Q_I = 20.4 \left(\frac{\Delta F_T}{\psi_1 + \psi_2}\right)^{1.852} \left(\frac{\rho}{\mu}\right)^{0.0869} \quad (26)$$

$$Q_{II} = 20.4 \left(\frac{\Delta F_T}{\psi_3 + \psi_4}\right)^{1.852} \left(\frac{\rho}{\mu}\right)^{0.0869} \quad (27)$$

Adding Eqs. (26) and (27) gives

$$Q_T = (Q_I + Q_{II}) =$$

$$20.4(\Delta F_T)^{1.852} \left(\frac{\rho}{\mu}\right)^{0.0869} \left[\left(\frac{1}{\psi_I}\right)^{1.852} + \left(\frac{1}{\psi_{II}}\right)^{1.852}\right] \quad (28)$$

The total resistance of such a combination is apparent from the above expression. The resistance of each set of pipelines in series must be found first. Then the total resistance is found by use of the reciprocal relationship for the main lines in parallel.

—End

AW

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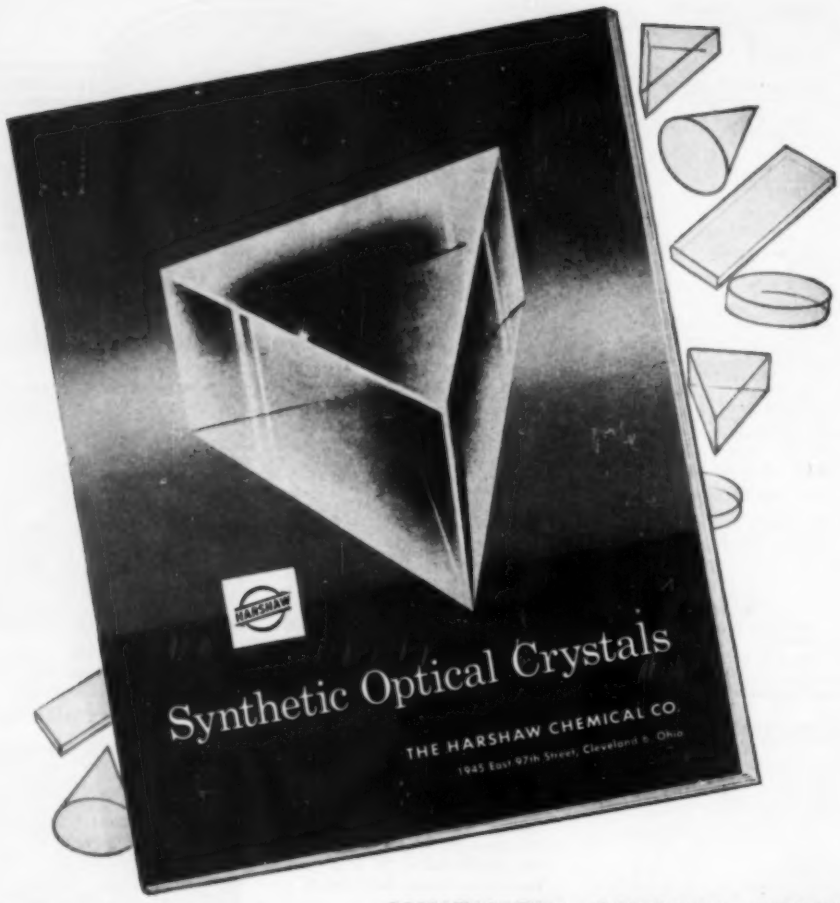

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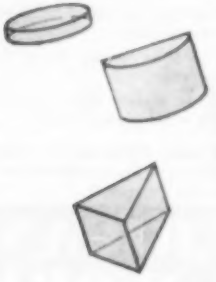

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  30 & 31

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How Important Is Fischer-Tropsch Synthesis?

Processes of Franz Fischer and Hans Tropsch may someday become important in the use of our fuel resources. Meanwhile you can have a record of what's been done so far.

Next time you hear someone mention the Fischer-Tropsch synthesis, ask him what he means. Chances are he will be vague and mention something about petroleum from coal or from carbon monoxide. He's wrong. If you want to know, or if he does, consult a new book* on the "process for synthesis of chiefly liquid aliphatic hydrocarbons, alcohols, and minor amounts of aldehydes, fatty acids, and ketones by hydrogenation of carbon monoxide." That's a mouthful of a definition, isn't it? Well, the process is something to chew on if you think you can understand it.

You won't understand it all. I wonder if there is some inverse ratio between our knowledge and the volume of printed matter on any subject. How much has been written on religion? On cancer? On golf? On Fischer-Tropsch?

Here is a guide to the amount of literature on the F-T synthesis: the book we are considering today has 525 literature references—an average of 87½ per chapter. And therein lies its greatest value. Three associates in the research and development branch of the Office of Synthetic Liquid Fuels (Bureau of Mines) have collaborated on it. They present all the available information systematically in six chapters.

Not only do they present and evaluate published material, they also review their own book. On p. 3 is a paragraph which starts:

"Written primarily for chemists and chemical engineers engaged in Fischer-Tropsch or similar process development, this book presents the basic chemistry of the process, the results of catalytic testing and pilot-plant development work, and data on industrial operations."

This introduction to their unusual self-appraising book review is literally accurate. But it is a little misleading. Things aren't that simple. There are not four nice subdivisions, complete, and leading smoothly from one to the next. There has been too much published. And captured German data, on which the book is based primarily, was too voluminous and varied in detail to make a smooth, neat, logical presentation.

So the authors are right. It is for those actually "engaged" in F-T development. Others will find it mighty tough going. For example, let's go on to . . .

"The first chapter [which] describes the structure and reactivity of hydrogen, carbon monoxide, and the metals commonly used as catalysts, as well as the thermodynamics of reactions of these compounds." True. And the metals are iron, cobalt and nickel. It's straight-forward physical chemistry, too. Equilibrium constants, free energies of formation, thermodynamics of incorporating methane into the F-T synthesis, heats of reactions of formation, electronic structure of elements involved in the F-T synthesis. All this is fundamental for "those actually engaged."

"Chapter 2 presents an introduction to heterogeneous catalysis: the methods of studying catalysts and catalytic reactions and a discussion of the three reactions related to those of the Fischer-Tropsch synthesis." It goes into precipitated, decomposition, impregnated, skeletal, fused, cemented and powdered catalysts. Methods of studying catalysts: chemical analysis, x-ray diffraction, electron diffraction and magnetic methods. It goes into density, surface area, pore size and even tagged atoms. This chapter, with the highest ratio of literature citations per page (1.34), is a reporting of fundamental theoretical investigations. Most of them were carried on in this country. The three processes mentioned in the quote are hydrogenation of olefins, synthesis of ammonia on iron catalysts, catalytic synthesis of methanol and higher alcohols.

"Chapter 3 contains a review of the development of catalysts for the hydrocarbon synthesis. Here catalyst composition and methods of preparation and pretreatment are related to catalytic activity." It's also the longest chapter. It's mostly reports—in great detail—of German experiments, results and practice supplemented by Bureau of Mines data. Catalyst treatment is very important: reduction, carburization, reactivation. Also studied: sources of iron, effect of alkali, carriers, cemented iron. There are some data on commercial processes in Germany. But most are too high up into the theoretical research level of "about 20 cc. of freshly prepared catalyst" to be really fascinating reading.

"Chapter 4 presents the laboratory and industrial development of the Ruhrchemie process, as well as more recent pilot-plant developments in Germany and in the United States.

(Continued)

Did You Know?

"At moderate temperatures, most organic molecules do not react with molecular hydrogen except in the presence of catalysts." Chap. 1

"Theories of catalysis have not developed sufficiently so that a catalyst for a given reaction may be designed from a consideration of only the bulk-phase chemical and physical properties of the constituents." Chap. 2

"Under conditions of normal German peacetime economy, the process should be utilized for the production of aliphatic chemicals and special products such as waxes and high-grade lubricants, rather than fuels." Chap. 3

"This combination of a highly exothermic reaction with a relatively narrow range of optimum operating temperature makes the problem of removal of the heat of reaction most important in the design of the process and its equipment." Chap. 4

"The word 'oxo' is from the German 'Oxierung,' meaning ketonization." Chap. 5

"Although the synthesis has been studied rather intensively for the last twenty-five years, many aspects are not very thoroughly understood." Chap. 6

Quotes from "The Fischer-Tropsch and Related Syntheses"

* THE FISCHER-TROPSCH AND RELATED SYNTHESES. By Henry H. Storch, Norma Golumbic and Robert B. Anderson. John Wiley & Sons, New York. 610 pages. $9.

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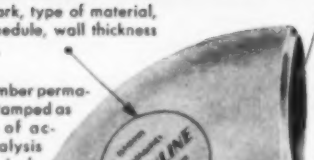

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BOOKSHELF, *cont.* . .

The different Fischer-Tropsch processes are classified according to the physical form of the catalyst and the method of removing the heat of the reaction. The productivity, relative efficiency, and versatility of the various processes are compared. This chapter concludes with a brief appraisal of the economic studies of Fischer-Tropsch processes." As a factual report of full-scale German operations this chapter is pretty good. It goes into fixed beds, recycle, heat exchange and other real plant-size operation. But soon we are back again to the laboratory tests "170 cc. of catalyst . . . in a bed 80 cm. in depth." This skipping around rather than sticking to one subject is disconcerting throughout the book. It will make hard work for the user. To confirm my impression of disorganization, I looked at the index. There I found, for instance, three widely scattered references on the effect of retention of wax on the activity of cobalt catalyst. That subject sounds as if it could have been cleaned up all in one place. Here are others: seven different page references from 91 to 402 where preparation of fused iron catalyst is described; 14 on magnesia as a promoter for cobalt catalysts. The fourth chapter winds up with two pages on costs. They conclude that more pilot-plant data are needed.

"Chapter 5 describes processes related to the Fischer-Tropsch synthesis, such as the oxo [13 pages] and isoparaffin [10 pages] syntheses." And as such it should have been Chapter 6. The histories of the two processes are excellent literature reviews. While . . .

"The last chapter relates activity and selectivity of catalysts to the variables of operation and to the phases present in the catalyst during use in the synthesis. The chapter concludes

RECENT BOOKS RECEIVED

Adsorption. 2nd ed. By C. L. Mantell. McGraw-Hill. $9.
Chemical Analysis of Foods and Food Products. By M. B. Jacobs. Van Nostrand. $9.
The Chemistry and Action of Insecticides. By H. H. Shepard. McGraw-Hill. $7.
The Chemistry and Technology of Food and Food Products. 2nd ed. By M. B. Jacobs. Interscience. $12.
Chemistry of Organic Compounds. By C. R. Noller. Saunders. $7.
Electroplating. By J. B. Mohler & H. J. Sedusky. Chemical. $5.
Marine Products of Commerce. 2nd ed. By D. K. Tressler & J. M. Lemon. Reinhold. $18.
Medicinal Chemistry. By A. Burger. Interscience. $10.
Optical Crystallography. 2nd ed. E. E. Wahlstrom. Wiley. $4.50.
Principles of General Chemistry. 4th ed. By S. R. Brinckley. Macmillan. $5.

with a critical discussion of the mechanism of the synthesis." It starts with a review of the literature on carbides—their formation, hydrogenation and thermal decomposition—because of the hypothesis that the synthesis proceeds through formation of an intermediate metal carbide. Nickel, cobalt and iron carbides, and elemental carbon are covered. Next is kinetics, then physical and chemical nature of used catalysts for the three metals. The book winds up with interpretation and reporting of distribution of products from the F-T synthesis (oxygenated compounds and hydrocarbon products); theories of the mechanism of F-T synthesis; studies with C^{14}.

"The availability of this book . . . will save time and effort for those having new or old interest in the Fischer-Tropsch synthesis." As long as we are using quotes, let's conclude with that one from the publisher. It can be revised: ". . . for those having serious or intense interest in the Fischer-Tropsch synthesis." This revised quote and our exploration of the authors' review tell you whether or not you want to buy the book.—*LBP*

The Last Word

FLOW MEASUREMENT WITH ORIFICE METERS. By Reid F. Stearns, Robert M. Jackson, Russell M. Johnson and Charles A. Larson. D. Van Nostrand Co., New York. 350 pages. $7.50.

We may not have here the last word on orifice meters, but this book leaves precious little more to be said. In fact, you might wonder just how even four people working together could say as much as they have within their self-imposed limitation to "installations in closed conduits, using flat plate, square-edged orifices." We are reminded of the time-worn definition of the specialist as the individual who learns more and more about less and less until eventually he knows everything about nothing.

Mr. Stearns and his co-authors have purposely aimed their book at the engineer in the petroleum industry. In view of the facts that the authors are associated with Standard Oil Development Co. and that the book is listed as one of the "Esso Series," this attitude is understandable. It is also justifiable if we accept as typical the authors' count of metering equipment installed in an unidentified large refinery—they list orifice meters as comprising nearly 90 percent of the total, with rotameters at least 5 percent. In other process industries, we venture to say, orifice

(*Continued*)

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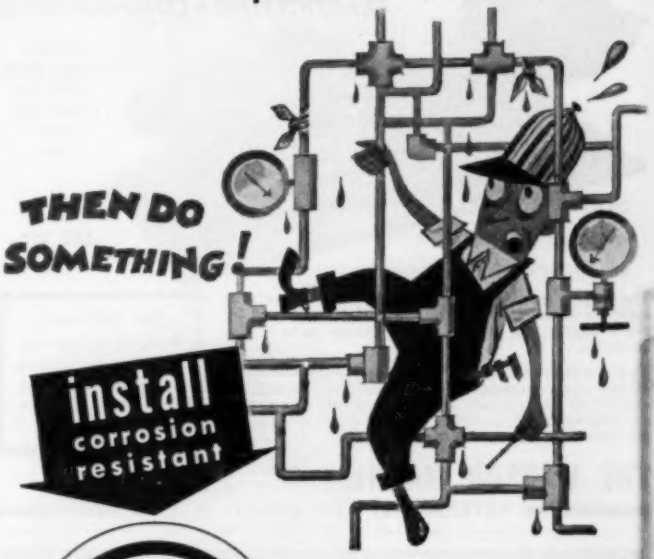

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meters are not nearly so predominant.

Commendation is due the authors on the excellent organization of their material. The subject follows a logical development from one chapter to the next. Supplemental information is segregated in a comprehensive appendix.

Especially useful is a 4-page complete listing of symbols which precedes the text proper. Although each symbol is defined as it is introduced in the text, this list is a welcome aid to anyone using the book for occasional reference.

Chapter IX "Special Metering Problems," may well be worth the price of the entire book. It deals with pulsating flow, metering liquids near their bubble point, gas law deviations, flow-limiting orifices, eccentric and segmental orifices, and small rates of flow involving low Reynolds numbers.

The attention to detail shown by the authors can be illustrated by a few random examples: We are told that the ratio of orifice diameter to pipe diameter should be based "on the actual measured value of the inside pipe diameter rather than on the inside pipe diameter tabulated for the scheduled pipe size." They warn us that "when flow temperatures are appreciably different from the standard reference temperature of 60 deg. F., the effect of thermal expansion of the orifice must be considered." We might find it rather difficult, however, to make sure that the departure of an orifice plate from flatness along any diameter does "not exceed 0.005 in. when clamped between orifice flanges."

Typography is excellent. Our only criticism is the use of blue ink throughout the book. Although it gives the graphs and line drawings a pleasing appearance, it makes the halftone illustrations look like the ghastly prints we used to turn out back in school by feeding snapshot negatives to the blue print machine.—*CHC*

Surfactants

SYNTHETIC DETERGENTS. By John W. McCutcheon. MacNair-Dorland Co., New York. 435 pages. $7.10.

Reviewed by A. H. Pope

There has been a great need for a comprehensive text covering the fundamentals and applications of surface chemistry and including a discussion of the general nature of surface active agents, their manufacture and commercial uses. This book will fill the need. When discussing uses, the author has not dwelled excessively on a

specific application while passing over others more lightly than is warranted by their importance.

The first portion of the book covers the fundamentals of surface activity, evaluation methods, and the analytical examination of detergents. While none of this material is new, the author has assembled a rather complete list of testing methods and analytical procedures. For this latter material McCutcheon draws heavily on the procedures of the American Oil Chemists Society and has included the texts of some of their methods in the appendix. In his discussion of surfactants the author has used 14 general classifications and adequately covers the general chemical and physical characteristics of each. The 35 pages covering manufacturing processes are distributed among the various types of agents in proportion to their commercial importance. One very enlightening chapter has been devoted to trade name products and detergent formulation. This is augmented by appendix tables covering surfactant classification and giving a list of the commercially available agents with use information, etc.

The last chapter, over 80 pages long, discusses applications and uses. General applications such as emulsification, dispersion, detergency, etc., are first covered followed by a well balanced discussion of applications in specific industries.

This book will be of strong interest to industrial chemists and to students desiring a good background on the general subject of surface active agents. This is the first book the reviewer has encountered that might be used as a text for a general course on a subject of rapidly increasing importance.

Important

COLLOIDAL DISPERSIONS. By Earl K. Fischer. John Wiley & Sons, New York. 387 pages. $7.50.

Reviewed by G. F. Kinney

Both the theoretical and practical aspects of colloidal systems of solids dispersed in liquids are covered in "Colloidal Dispersions." The first chapters of this new monograph supply theoretical background. The concept of particle size and various significances attached to the term are discussed, and the methods of measurement described. The various methods are compared, and data for various solids given. The nature of surfaces and interfaces, including wetting, energy aspects, and the debatable contact angle, are covered. The mechanism of

(*Continued*)

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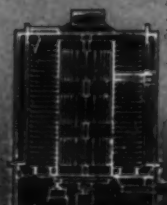

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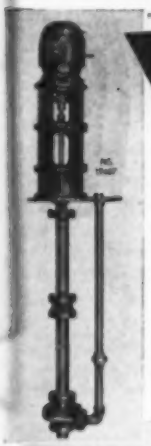

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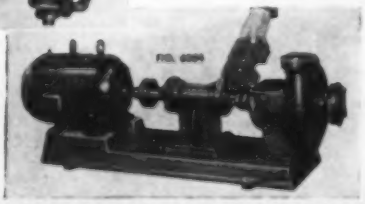

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the dispersion and flocculation processes, and methods for control of some of the physical properties are described. The rheological properties of dispersions and the importance of rheological effects are illustrated with specific practical examples. One entire chapter is devoted to surface-active agents. The approach to all of these is from the viewpoint that the physical properties of the systems are related primarily to the nature and extent of the interfaces between solid and liquid.

The latter part of the book is concerned with the unit operations of crushing and grinding, of mixing, and of the newer "flushing" process whereby a dispersed solid such as a paint pigment is transferred from one phase to another, as from water to oil.

The material is presented concisely and readably, and is extensively documented. It is an important addition to the literature of colloid chemistry, and in particular to the technology of paints, pigments, rubbers, inks, ceramics, and other fields where colloidal dispersions are involved.

Alembication

DISTILLATION. Edited by Arnold Weissberger. Interscience Publishers, New York. 668 pages. $14.

Reviewed by F. C. Nachod

Distillation is an old art and it would indeed be curious to speculate what organic chemistry would be today without this powerful technique. The path of development from the retort of the paintings of old masters —now only found on the insignia of the Army's Chemical Corps—to the stills of modern refineries is an impressive document for the skill of chemists and engineers. In the present text, under the able editorial guidance of Dr. Weissberger, nine experts (A. Rose, E. Rose, A. L. Glasebrook, F. E. Williams, C. S. Carlson, J. R. Bowman, R. S. Tipson, E. S. Perry, J. C. Hecker) report on all facets of distillation. The theoretical scientist will find a wealth of information in the chapter on theory while the practical engineer will benefit from the chapters on fractional distillation, extractive and azeotropic distillation, high vacuum work, or sublimation.

Chemical engineers are generally concerned with distillation problems. While this book is not addressed exclusively to them, they more than any other group will be delighted about the appearance of text as well planned and executed as this Vol. IV of "Technique of Organic Chemistry."

Bright and Virile

ENGINEERING AND WESTERN CIVILIZATION. By James Kip Finch. McGraw-Hill Book Co., New York. 397 pages. $5.

Reviewed by Walter Miller

Engineers—and enlightened laymen who sense that our picture of man's development is woefully incomplete—have waited long for a good general history of engineering. There have been a few satisfactory studies of single branches of the profession, such as Kirby and Laurson's "Early Years of Modern Civil Engineering"; and there have been a few comprehensive works on certain periods, such as Parson's monumental volume, "Engineers and Engineering in the Renaissance." But until now we have had only one attempt at a general history: Fleming and Brocklehurst's "A History of Engineering," a feeble, narrow, and uneven book to whose shortcomings time has added obsolescence (it appeared in 1925).

Now with the publication of "Engineering and Western Civilization," by Dean Finch of Columbia University, we have our first authoritative study of the part the engineer has played in shaping our society.

Dean Finch attacks his job with valuable experience and an appropriate attitude. He has made a lifetime study of engineering history, has given at Columbia one of the few courses in the subject conducted in our schools, and has written for his own use a 20-volume master-history of which this book is a potent distillation. He has a broad but intellectual grasp of his subject, a calm ability to counter the Platonist tradition which has disparaged or ignored the historical significance of practical pursuits.

Thus equipped he unravels an exciting yarn of 50 centuries. On the story level, he talks about the ancient master builder, the ingeniator, gunpowder, the rise and fall of the Leblanc process. Actually he constantly probes for reasons and causes: why Egypt's engineering never grew out of adolescence, how the profession shifted its emphasis from public works to industry, why England lost her industrial virility. The reader comes to modern America, to which two-thirds of the book is devoted, thoroughly aware that there is a delicate organic relationship between engineering and economics, that the health of a civilization depends upon a close coordination of technological advance with social progress. It is no surprise that the book ends with the engineer concerned not only with new substitutes for Nature's gums and fibers, but

(Continued)

Submerged Combustion

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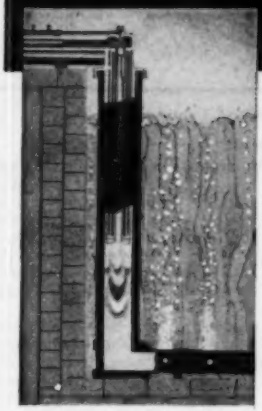

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with the changes in human affairs he has helped bring about.

From his story Dean Finch extracts an "engineering interpretation of history." His thesis deflates the "great man" theory, emphasizing the cumulative progress of men working together; reinforces the economic interpretation, stressing the engineer's part in providing the material prerequisites for civilized life; and puts the ideological theory in better perspective, as a partial not a major explanation of man's growth. He sees engineering as a democratizing force, "equalizing inequalities," "forcing man out to ever more intimate relationships with his fellow man," "releasing men from the tyranny of man," giving the human animal his greatest faith in himself. He ridicules the conventional belief that engineering is the poor relative of natural science, showing rather that the relationship is one of mutual profit between two historically independent professions.

The chemical engineer will find this book a real orientation and in some ways a challenge. It traces his origins to antiquity and appraises him as "an outstandingly important and dynamic figure in modern life," and throughout there is the exciting buildup toward today's demand for new and better materials. But even where the discussion is not directly related to his specialization, the chemical engineer will identify with Finch in his concern with industrial growth, the nature of research, the struggle with the propaganda of pure science. Most provocative are the essays on the relationships with farmer, capitalist and worker, which the engineer must revaluate and help reshape, because "he is the principal professional man of our modern technological industries."

Some readers will object to Dean Finch's heavy reliance on the doctrines of Lord Keynes and Sir Norman Angell; many will feel that his conclusion on the future of technology in a democracy is more sentiment than blueprint. But even if his answers do not satisfy everybody, he raises questions which no one can escape by merely disagreeing with him.

"Engineering and Western Civilization" is written with the engineer's aptitude for functional design; it is as readable as a flowsheet. The language, although sometimes suffering from echoes of itself, is bright, virile, humane. At the end the reader's continued interest is correctly anticipated with a critical bibliography which is in effect a pioneer appraisal of the literature of engineering.

DEPARTMENT OF THE MONTH

Recent Books & Pamphlets

(*Continued from p. 142*)

Subject	Summing Up	Ordering Data
Sea Products	Chapters on salt from sea water, refining of sea salt, magnesium, bromine and other products from sea water. A naturally large proportion of the treatise is devoted to fish and the science and technology of their preparation preservation. 782 pages	"Marine Products of Commerce," by Donald K. Tressler and J. M. Lemon. Second edition. Reinhold Publishing Corp., 330 West 42nd St., New York 18, N. Y. $18.
Plant Layout	The basic mechanics for setting up a manufacturing operation (for industry at large); aimed particularly at the man who must actually do the job. Planning the production line, designing plant services. 391 pages.	"Plant Layout, Planning and Practice," by Randolph W. Mallick and A. T. Gaudreau. John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. $7.50.
Prices	Compiled from price quotations reported by Oil, Paint and Drug Reporter over the past four years on all commercially known coal tar, fine, heavy, textile and leather chemicals; also drugs, aromatics, essential oils, oils, fats and waxes. 244 pages.	"OPD Record of Prices on Chemicals and Related Materials." Vol. 1A. Schnell Publishing Co., 30 Church St., New York 7, N. Y. $6.25.
Safety	First aid leaflet. Guide for plant safety workers in one type of emergency.	"Salt and Soda for Shock in Burns." Public Health Service, Washington 25, D. C. Gratis.
Fittings	Covers minimum requirements (pressure ratings, dimensions, tolerances, etc.) for 300-lb. fittings in sizes 1¼ to 3 in., inclusive. 12 pages.	"Malleable-Iron Screwed Fittings." ASA B16.19-195. American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. Gratis.
Defense	A directory of government emergency agencies as existing in March 1951.	"Handbook of Emergency Defense Activities." General Services AdministrationSu.pt. of Documents, Washington 25, D.C. 25 cents.
Oil Analysis	Detailed instructions for all tests, a bibliography, and an extended compilation of crude oil analyses.	"Analytical Method, Part I, Bureau of Mines Routine Method for the Analysis of Crude Petroleum," by N.A.C. Smith et al. Bulletin 490. Supt. of Documents, Washington 25, D. C. 50 cents.
Water	Indicates typical quantities available, major factors in water movement and principal present industrial uses. A very general statement but including some significant statistics by regions.	"A Summary of the Water Situation in the U.S. with Special Reference to Surface Water." Geological Survey, Washington 25, D.C.
Plant Administration	A new pocket-sized monthly containing digests of particular interest to foremen. A sampling of the 19 articles in the first issue (May): "What Labor Costs", "Defense will Hurt", "Avoiding Grievances."	The Foreman's Digest, 18 South Dean St., Englewood, N. J. Subscription: $6 a year.

—*End*

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SUBJECT	FEATURES	COMPANY
Pressure Guard 274A	Known as a Safety Heads, this company's pressure relief device consists of a pre-formed metal rupture disk (and a vacuum support, when required) that is held between two specially-machined flanges. Photographs show specific industries in which they are used and what purposes they serve. Specification tables, sketches and cutaway photographs show how to choose the right assemblies and parts for various applications. 52 pages.	Black, Sivalls & Bryson, Inc.
Piping 274B	Hints on the application and maintenance of piping equipment. Discusses the various types of valve designs and how each should be used. Illustrates and names more than 80 kinds of fittings. 36 pages. Included with the manual is a valve selection guide for common piping services. 8 pages. Also available for free showings (a dramatic film to dramatize the information in the manual) is a 30-min., 16 mm. sound film.	Crane Co.
Stainless 274C	Two new stainless steels that can be hardened at low temperatures: Armco 17-4 PH and 17-7 PH. Corrosion resistance, heat treatment and mechanical properties, fabrication, and forms in which the steels are supplied. Photographs show typical applications. 16 pages.	Armco Steel Corp.
Heat Exchangers 274D	Film type exchanger which can utilize dirty water and can be cleaned while in operation. Construction and design illustrations. Installation photographs. 8 pages.	Henry Vogt Machine Co.
Plastics 274E	Data on tubing, pipe, valves and fittings of Ace-Saran and Ace-Parian (polyethylene) plastics. Tables of properties and of resistance to a long list of common chemicals. Bursting and working pressures, standard sizes and weights. 16 pages.	American Hard Rubber Co.
Instruments 274F	Photographs and cut away drawings of a line of temperature control apparatus. 12 pages.	H-B Instrument Co.
Valves 274G	Piping, mounting, and wiring data for power operation of lubricated plug valves. Diagrams, cutaway drawings, specifications tables. A large section is devoted to installation photographs showing use of the valves with cylinder operators, electric motor operators, pneumatic motor operators. 42 pages.	Rockwell Mfg. Co.
Packings and Gaskets 274H	Complete descriptions, including large cross-sectional drawings of the line. Charts give recommendations for packing various types of equipment against a long list of services. Engineering data including procedure for proper installation of packings, common causes for packing failure. 100 pages.	Raybestos-Manhattan, Inc.
Heat Transfer 274I	Specialized heat transfer surfaces custom built to specific requirements. Samples pictured are applicable to such equipment as solvent recovery, intercooling, regeneration, heat economizing, drying and gas separation and liquefaction. 4 pages.	Modine Mfg. Co.
Instruments 274J	Lists and describes a variety of bulletins on the products of each of the companies which compose B-I-F Industries: ⅝ Proportioneers ⅝ (standardized machines for automatic treating, feeding, diluting, blending, proportioning and sampling); Omega Machine Co. (volumetric and gravimetric feeders for dry materials and feeding of liquids by gravity); Builders-Providence, Inc. (instruments for metering and controlling flow, liquid level, temperature, pressure, weight). 8 pages.	B-I-F Industries
Equipment 274K	For production, handling and storage of liquefied gases. Brief descriptions, photographs and operating diagrams of such equipment as helium liquefiers and oxygen generators. 10 pages.	Arthur D. Little, Inc.
Dryer 274L	Vertical continuous transfer type which features repeated spreading and turning of material. Suggested for fragile or heat-sensitive granules, beads, powders, crystals, pastes, sludges, slurries. Diagrams show construction, heating arrangements and types of applications. 6 pages.	Wyssmont Co.
Instruments 274M	Suggested applications of an all-electric method, utilizing a load-cell recorder, for continuously measuring and recording thrust, pull, torque, weight, fluid pressure—stresses and loads of all types. 4 pages.	Leeds & Northrup Co.
Company History 274N	"Six Steps in Planning a Company History or Anniversary Book." The steps, discussed successively, are: Analyze your possible readers; examine what others have done; consult an experienced printer; select an able writer and facilitate his work; consider tie-in use of your history; develop accurate specifications for buying. 27 pages.	William E. Rudge's Sons
Heating Coils 274P	Covers five types: flexible seamless tubes, single pass construction for pressures from 1 to 200 psi.; straight tube type, single pass construction, for pressures from 1 to 200 psi.; semi-multi-pass coil, seamless tube construction, for from 2½ to 200 psi.; continuous, multi-pass, seamless tube construction for from 25 to 450 psi.; continuous seamless tube construction, in single row type, without casing. Illustrations and specifications charts give complete data on the proper uses of each. 62 pages.	Aeroflo Corp.
Turbine 274O	Vertical drive steam turbine. Cutaway view clearly labeled with part names and functions. Dimension diagram and chart for the three general sizes of this model. 4 pages.	Whiton Machine Co.
Tractor-Shovel 274R	Application photographs of 12 cu. ft. tractor-shovel for bulk materials handling.	Frank G. Hough Co.

SUBJECT	FEATURES	COMPANY
Nozzles 275A	How to solve almost any production spraying problem with the proper nozzle chosen from Spray Engineering's standard line. Individual performance charts for 128 center-jet full cone nozzles (capacities: 0.2 to 1,000 gpm.) portray spray patterns at different operating pressures and provide complete structural data and capacity tables at pressures to 100 psi. inclusive. Physical characteristics and performance data on other products including rampbottom (non-clogging), type "F," flat spray, two-fluid nozzles and self-cleaning strainers. 148 pages.	Spray Engineering Co.
Instruments 275B	Combustion safeguard for industrial gas-fired and oil-fired burners. Detection of flame failure immediately followed by safety shut-down. Blueprints show principle of operation, typical installation, its use in different safeguard systems. Bills of material, specifications and capacities, accessories. 32 pages.	Minneapolis-Honeywell Regulator Co.
Coating Equipment 275C	Continuous coating equipment for such web materials as textiles, papers, films and foils and strand materials such as wires, cables and synthetic monofilaments. Some 50 drawings and photographs keyed to the text. 16 pages.	Industrial Ovens, Inc.
Valves 275D	Covers hundreds of standard models and modifications straightway, three-way, four-way and four-way five port units in various sizes of hand, foot, solenoid, pilot, remote control, cam, speed control etc. valves. Sectional views, installation data, diagrams. 44 pages.	Ross Operating Valve Co.
Piping 275E	Photographs show piping installations in chemical process plants, oil refineries, heating plants, water pumping stations, heating plants, central power stations and for gas transmission system. Engineering and fabrication facilities. 24 pages.	Dravo Corp.
Tubing 275F	Guide for engineers, designers and fabricators in choosing the proper material and as a help in planning the conversion of stainless steel tubing into finished products for industry. Methods of manufacture and inspection, corrosion and oxidation resistances, and methods of working and fabrication. Liberal use of photographs, detailed diagrams. Tables on eight stainless alloys covering physical and mechanical properties and processing data along with a list of applications. Pocket-sized, leather bound booklet. 104 pages.	Babcock & Wilcox Tube Co.
Resins 275G	Resins for adhesives—a report on their contribution to film cohesion, bond strength, surface tack and other properties. Examples of the use of a variety of resins in the formulation of rubber, cellosic and water soluble adhesives. 18 pages.	Hercules Powder Co.
Rubber 275H	Nitrile synthetic rubber. Properties, compounding techniques, range of applications particularly in pressure adhesives. 30 pages.	Goodyear Tire & Rubber Co.
Speed Reducers 275I	Two bulletins. One covers a double reduction Torque-Arm series. 16 pages. The other covers a single reduction series. 12 pages. Large, clear illustrations of the products and their mechanism. Selection tables which give not only the right reducer for any installation but also the size of V-belts and sheaves required for the drive.	Dodge Mfg. Corp.
Piping 275J	Facilities for prefabrication of piping sub-assemblies. Photographs show pipe bends, coils, headers, process piping for chemical and heavy industries, petroleum refining, pipe line transmission, etc. 8 pages.	Lummus Co.
Hose Clamps 275K	A locking device originally designed for making leakproof hose connections, now used to solve such problems as splicing electric cable, repairing leaks in pipe lines. Design and applications are illustrated. Lists standard clamps, locking tools, special fittings available. 12 pages.	Punch-Lok Co.
Laboratory Supplies 275L	Over 3500 items are illustrated and briefly described. A separate bold face catalog number is assigned to each size and style of a particular item for easy ordering. Hard cover. 896 pages.	New York Laboratory Supply Co.
Packing Rings 275M	Construction drawings, diagrams and photographs. Suggested applications for five types of ring. 4 pages.	Raybestos-Manhattan, Inc. Packing Div.
Centrifugals 275N	For the chemical and process industries. Photographs and diagrams of the machine its parts and accessories for special applications show construction and operation. 22 pages.	Fletcher Works
Capacitors 275P	Slide-rule-type chart explains the use of capacitors in solving low power factor problems. What low power factor is, what it means to the power user and supplier.	Westinghouse Electric Corp.
Separators 275Q	Non-electric permanent magnetic separators for tramp iron removal. Specifications and installation are covered with diagrams and tables, also various types of assemblies and accessories. 16 pages	Eriez Mfg. Co.
Wiring 275R	Liquid-tight, flexible electrical wiring conduit. Installation and construction photographs. 4 pages.	American Brass Co.
Sealing 275S	Specification for Teflon shapes for sealing acids, alkalies, petroleum hydrocarbons and mixtures of these commodities at temperatures of —90 to 500 deg. F. Sheets, cylinders, bars, rods, tubing. 8 pages.	John L. Dore, Inc.
Consultant 275T	Chemical, mechanical and electrical research engineers. Case histories involving such problems as by-products, new products, cost reduction, waste disposal. 16 pages.	J. B. Calva & Co.
Motor Protection 275U	High-voltage combination-starter. For three-way (circuits, motors, and personnel) protection for squirrel-cage, synchronous, wound-rotor and multi-speed motor installations. Keyed photographs, graphs, oscillograms.	Westinghouse Electric Corp.
Equipment Accessories 275V	Valves, flanges, hose nipples, bars, welding electrodes, screw machine products. Specifications, applications and illustrations. 6 pages.	Worthington Pump and Machinery Corp.

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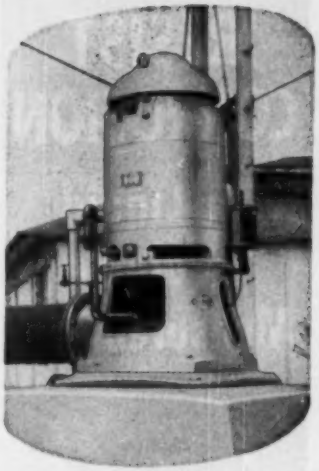

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SUBJECT	FEATURES	COMPANY
Flanged Outlets 276A	Seamless forged steel outlets for pressure vessels, boilers, heat exchangers. Sections on necks and nozzles, large diameter flanges contain dimension diagrams and charts, tapping and construction photographs. Section on modern flange design covers design assumptions and calculation method, comments on codes, materials, marking and design practice, data sheets, charts and design procedure. 118 pages.	Taylor Forge & Pipe Works
Pump 276B	Rubber protected pump for handling water or liquids containing abrasive materials. Color keyed cross-sectional drawings show construction and operation of models for sand, dredging and slurry. Performance-selection chart. 16 pages.	Allen-Sherman-Hoff Co.
Sulphide Roasting 276C	A new method for producing SO_2 gas from pyrites by utilizing the principle of fluidization. For H_2SO_4 manufacture and paper mill and other industrial uses. Cutaway photograph showing apparatus; flow and general arrangement diagrams. 4 pages.	Dorr Co.
Instrument 276D	Atomic energy-operated device designed for measuring catalyst level in a Houdriflow catalytic cracking unit. Recommended for the measurement of all liquid levels and fluid densities through container walls. 2 pages.	Minneapolis-Honeywell Regulator Co.
Speed Reducers 276E	This company's type H worm, helical worm, and double worm gear speed reducers. Product and installation illustrations, selection practices and load characters, rating tables and specifications. Price list and weight tables. 56 pages.	D. O. James Gear Mfg. Co.
Ventilation 276F	New periodical to present dust and fume control data and information applying to all segments of the chemical and metallurgical industries. First issue contains illustrated case histories on the application of cloth-tube filters to dust control problems in industries such as fertilizer, rubber, etc.	American Wheelabrator & Equipment Corp.
Aerogel 276G	Application of free-flowing aerogel in the formulation of lubricating greases. Summary of field test results. 4 pages.	Monsanto Chemical
Conveyor 276H	Flat-top conveyor chain for transportation of small containers, bottles, packages or parts through such operations as washing, bottling, packing, capping and labeling. Dimensions, construction diagrams and photographs. 4 pages.	Link-Belt Co.
Pumps 276I	Instructions for installation and operation of a line of centrifugal pumps. Diagrams. 8 pages.	Lawrence Machine and Pump Corp.
Hose 276J	Engineering data, construction specifications on a line including fire hose, dust conveying hose, lacquer spray and solvent hose. 16 pages.	New York Belting and Packing Co.
Expansion Joints 276K	Sizes, dimensions, suggested applications. Line ranges from small flexible connectors for use on diesel exhaust lines to 30-ft. diameter joints for use in such applications as wind tunnels. 4 pages.	Zallea Bros.
Heater 276L	Petroleum heat processing using radiant gas heat in tubular heaters. Photographs show installations, operating control. Sketches show operating principle, mechanical design. 16 pages.	Solaa Corp. of America
Refrigeration 276M	Line of hermetically sealed refrigeration compressors and condensing units, this company's types CL8-74, 110, 188 and 282. Illustrations, specification data.	Westinghouse Sturtevant Division
Alloys 276N	Charts give composite analyses of cast products (corrosion resisting alloys) standard types of wrought stainless steels, high nickel-chrome-molybdenum alloys. Pocket-sized folder.	Worthington Pump and Machinery Corp.
Motors 276P	Large, polyphase induction motor and where it fits into the industrial picture. Summary of the types and features of the two basic kinds: squirrel-cage motors for constant-speed drive (this company's type C8F); and wound-rotor motors for adjustable-speed drive (type CWF). Applications are illustrated for such industries as oil and chemical, paper, steel and metalworking, air conditioning. 28 pages.	Westinghouse Electric Corp.
Lubricant 276Q	Molybdenum disulphide as a lubricant. Excerpts from seven published technical papers (including photographs and graphs showing test results) on such subjects as oxidation characteristics, effectiveness as a fretting-corrosion inhibitor, friction properties under various conditions. 55 pages.	Climax Molybdenum Co.
Color Television 276R	Adapted to provide an instrument for industry maneuverable and simple in color control, lighting requirements and power needs. Suggested for the monitoring of hazardous operations. General working principle is illustrated. 8 pages.	Remington Rand Inc.
Vacuum Calculator 276S	Cardboard slide-rule device. Determines the needed pump capacity to evacuate a given volume to a specified vacuum in a given time and the time required to reach a specified vacuum in a given volume with a pump whose capacity is known.	F. J. Stokes Machine Co.
Welding 276T	Condensed summary of all symbols denoting the type of weld to be applied to a particular weldment as standardized and adopted by the American Welding Society. Specification tables on the different types of electrodes and additional suggestions for planning welded designs. 6 pages.	Lincoln Electric Co.
Tanks 276U	Three types of floating roof tanks for product conservation and corrosion prevention. Construction, installation and applications of each (double-deck, pontoon and pan types) are illustrated and described. 8 pages.	Hammond Iron Works

—End

5

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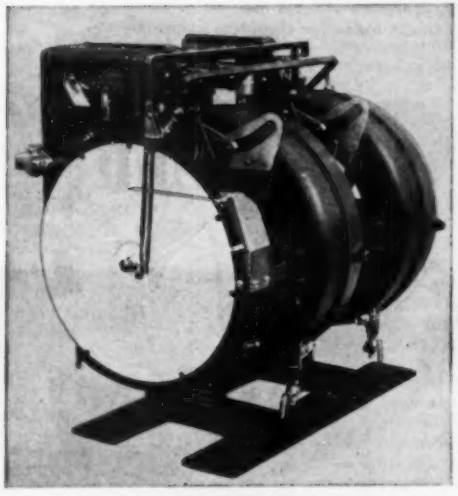
2 **THEY ARE ACCURATE**—Maximum rate of ring rotation occurs at low flow rates. Ample power to operate recording, integrating and other mechanisms is available over entire scale. High accuracy at low flows is especially advantageous where turndown range is wide.



Typical Hagan Ring Balance Dual Flow Meter with two low pressure-low differential rings — for recording and integrating gas flow and recording air flow.

3 **THEY ARE ADJUSTABLE**—Each ring assembly is adjustable for full scale differential over a range of 7 to 1. Rings are available for a continuous differential measuring range of ½ inch to 420 inches water column.

4 **THEY ARE SIMPLE**—There are no stuffing boxes or pressure tight bearings. No dampening devices are used. Level of mercury, or other sealing fluid, is not critical.

5 **THEY ARE RUGGED**—Design and materials produce precision results throughout a long life, requiring a minimum of personal attention, and costly maintenance.

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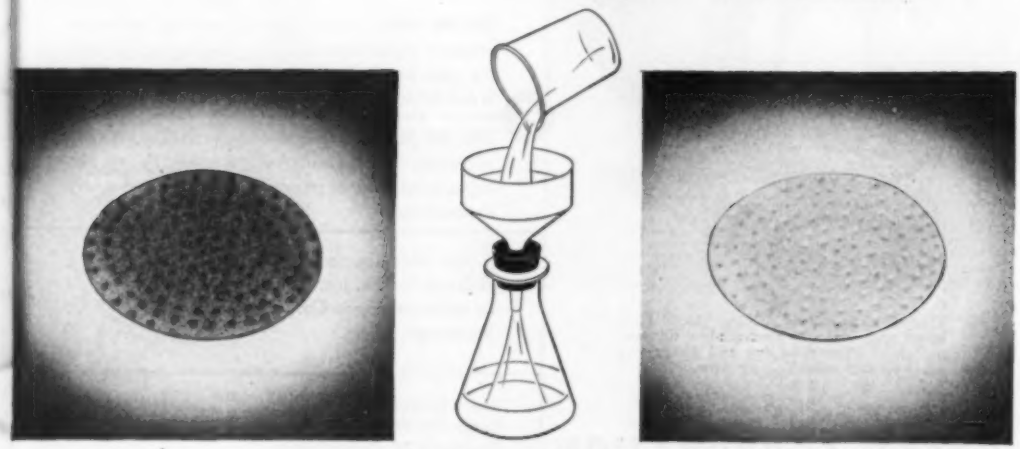

Without Gluconic Acid

A small amount of gluconic acid was added to one of two beakers containing an iron solution. Both solutions were made alkaline by the addition of caustic soda. In the case of the solution *without* the gluconic acid, a precipitate of ferric hydroxide was formed. The solution *with* the gluconic acid remained clear even though adjusted to the same alkalinity.

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What CPR-22 Means to Chemical Profits

Huge task of computing new chemical prices is not as serious as long-term expansion squeeze it creates. Here are some of tomorrow's headaches.

Chemical costs are built around three factors—like the legs on the stool the farmer uses to milk his cows. These are: (1) direct labor (2) direct raw materials and (3) overhead. To keep costs economically sound these factors must be kept in balance. We can not saw off two legs on the stool and expect it to work properly. We may be able to sit on it for a short time, but in the end it will tip over. This principle applies with equal force to chemical costs.

However, in the case of chemicals coming under CPR-22—the government's latest effort to control prices—there are factors for making adjustments of labor and raw material increases but none for increases in overhead. This is an area in which some price squeeze will occur in initial application of the regulation.

What the price order says—Main provisions of this regulation are as follows:

1. Manufacturers in the industries covered must file new prices by July 2. These prices will be determined by pre-Korea prices plus increases in factory payroll up to Mar. 15, 1951 and increases in materials costs up to Dec. 31, 1950 (or Mar. 15, 1951 for a few specified materials). Higher overhead costs don't count.

2. If a manufacturer of materials reduces his price on this basis, other manufacturers buying from him must reduce theirs proportionately. This second refiguring is to be completed sometime in the fall.

3. Thereafter, all manufacturers' prices are to be frozen. A company will get no relief, despite increased costs, unless it has an operating loss or its industry has pretax profits which are less than 85 percent of the average for the best three years of the period 1946-49.

New price ceilings will take no account of the increase in corporate tax rates or of accelerated depreciation charges on new plants—unless exceptions are made in a later ruling.

In the past two months the chemical firms have been trying to interpret and comply with the time schedule set up by the government for this price readjustment. To give *Chemical Engineering* readers an idea of how this regulation works, the McGraw-Hill department of economics has prepared a summary of the workings of the regulation.

Broad provisions of CPR-22 are relatively simple. However, its detailed application to individual prices is an accountant's nightmare. Many chemicals and chemical products are the result of operations in several producing units of the same company. Often each intermediate uses some chemical previously produced in the plant along with other raw materials purchased from other companies. Allocation of the costs of raw materials in 2,4-D production, for example, involves several intermediates. Some are purchased while others are produced by the manufacturer of the final product.

In the case of Du Pont the firm will have to determine which of its 6,000 products are covered by the order, then take the remaining items on the list and compute allowable increases in the labor and raw materials cost.

Eastman Kodak produces 3,200 organic chemicals which will have to be studied and cost adjustments applied to determine the new price for each item.

Because of these complications, many companies were unable to file new prices by the original deadline. The process of figuring out which new prices result in lower materials costs, and so require further reductions in finished goods prices, will be equally complicated, and may take even longer.

No one yet knows just how the profit standard (85 percent of 1946-49) is going to work. In most industries, there have been terrific changes in cost structure since the base period. It will be difficult to set up industry groups to which the standard can be applied, because some of the largest companies operate in several industries—and so would be under a different standard for each product line.

At the moment, these administrative difficulties seem more likely to provoke changes in the regulation than do any of the economic factors involved. At least, the loudest screams from the business community have been in protest against the complexity of the order, rather than against its general aims. However, long-range effects of CPR-22 on manufacturers' prices and profits are likely to cause far more serious trouble than the extra adding machines required for the original calculations.

Beginning of a profit squeeze—As outlined above, manufacturers' prices are supposed to be fixed by July 2 on the basis of pre-Korea prices plus increases in factory payroll to March 15, and in materials costs up to Dec. 31, 1950. Some companies had not allowed for these cost increases when they were caught by the January price freeze. Their prices will go up. Other companies over-anticipated actual cost increases in their January pricing. Their prices will have to be reduced.

It's hard to estimate exactly how these various adjustments will affect the average of all manufacturing prices. But OPS officials have said, off the record, that they don't expect the average to change more than 3 percent either way. Most private financial experts agree.

Where a manufacturer drops his price, the company he sells to will have to reflect the lower materials cost in a new price, to be filed sometime this fall. There will be some increases this way too. So if the regulation sticks, we'll come up to September or October with manufacturers' prices, on the average, not too different from what they are now.

But costs will keep going up in this period. The Wage Stabilization Board is about to authorize another round of pay boosts, breaking through the 10 percent ceiling. And these pay increases won't be figured in the price calculation. Neither will the higher depreciation charges on new plants. Nor will administration, research and other overhead expenses. So profits will begin to suffer.

Hard to get price relief—How long will the profit squeeze go on? Under CPR-22, the answer apparently is "in-

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definitely." Once the original adjustments are made, a manufacturer's prices will remain frozen for the duration of the emergency, unless he has an operating loss. The only exception will be where his industry has pretax profits under 85 percent of the average for the best three years of 1946-49.

That's going to make price relief mighty hard to get. In a boom period, operating losses will be few. And while some companies are earning less than 85 percent of their base period profits (before taxes), it's hard to find an industry that is. In the fourth quarter of 1950, pretax profits of all manufacturing corporations were 160 percent of profits in the fourth quarter of 1948, the best quarter in 1946-49. Final figures for the first quarter of 1951 should compare almost as well.

Individual industry figures are even more striking. Chemical industry profits ran 200 percent of 1948 in the fourth quarter.

Recent earnings have been affected by some inventory profits for many industries. However, even if the figures are pared down by the freeze date, this fall, there will be only a few small sections of the chemical process industries in a position to ask for price relief, then or anytime in the foreseeable future.

All this adds up to the fact that the chances of higher chemical prices are very slim, unless there is a new control plan.

Long-run damage—As time goes on (Mr. Wilson has said that controls are with us until 1953 at the earliest) frozen prices may begin to have a serious effect on manufacturers' profits. Payrolls will still rise, reflecting annual improvement factor, job differentials, overtime, and various fringe benefits. The new wage board shows no inclination to keep the lid on tight.

Overhead costs will also rise for many companies. For the past year, most plants have operated on increasing volume, with greater output per worker and less overhead per unit. But defense production, with its special problems, and materials shortages are likely to slow down production and boost overhead per unit for some time to come.

There are two big non-operating costs which promise to go up substantially. One is depreciation. Writing off a big new plant in five years—as many companies are doing under fast amortization—can cut profit noticeably if the increased write-off isn't allowed in pricing. It won't be under the present ruling. The other bogey is corporate taxes. They're slated to rise 5 percent this year, after a 9 percent boost in 1950. And these increases cannot be reflected in prices either.

Can profits take it?—Stabilizers think business profits can stand this squeeze. From a short-run point of view, they may be right. Recent profits have been very high. Some firms are going to be hurt by the new ceilings. But the majority, particularly the majority of the big concerns, are not in a position to complain very effectively on the basis of immediate hardship.

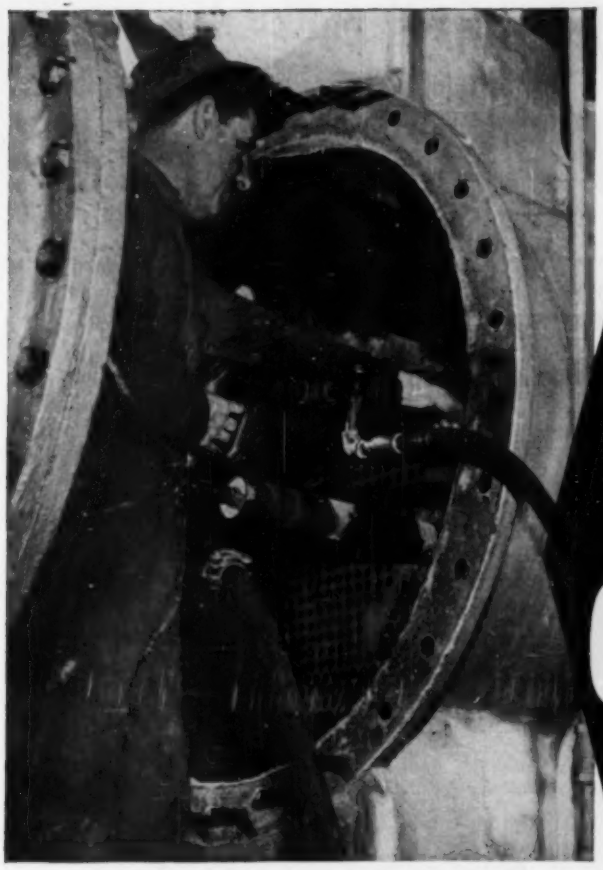
As long as profits remain anywhere near their current level, it's unlikely that many companies will reduce their plans for capital expenditures, for research, advertising or other items aimed at developing new business. In many cases, the first stage of the profit squeeze will reduce earnings that are subject to the excess profits tax anyhow. This will cushion the impact.

In the long run, however, profit control may prove an extremely costly experiment, both for business and for the nation. If the state of mobilization continues for several years, as we are told it may, frozen profits will eventually mean frozen budgets and a complete reversal of the expansionist thinking which has characterized business planning since the end of World War II.

As time passes, a profit squeeze is likely to complicate the effective operation of the defense production program. If costs continue to increase, more and more companies will find their margins squeezed to the point where it hurts. A company faced with large wage demands might decide to stand a strike rather than see its remaining profit wiped out. Another company might refuse to expand output, even though the goods were needed.

This kind of foul-up just can't be tolerated during a mobilization. So to keep production rolling, the 85 percent standard will probably have to be relaxed in more and more cases. When and how much depends on the strength of pressure to get rid of controls generally.

If profits are still controlled when mobilization begins to ease off, the danger to business incentives will become acute. Investment in new plant and equipment has always depended heavily on the level of corporate profits. Current earnings generally determine future investment. Thus 1950's record earnings—plus defense needs—produced record investment plans for 1951. Controlled profits in 1952 or 1953 can be expected to put a blight on ambitious plans for the investment needed after the current emergency. —End



Condenser Tubes must be... KEPT CLEAN

Newport shoots the brushes through the tubes with an air-water gun at 75 lbs. per sq. in. They come from the far end like projectiles. Another Revere contribution was to assist in the design of a target to stop the brushes without damage.

● Condenser tubes almost immediately acquire a film that protects the metal from corrosion. Such film is thin, and beneficial. If it does not form, the probability is that the wrong alloy has been selected. It is part of Revere's service to collaborate with you in selecting the alloy that will be most economical in the long run.

There is another and much heavier type of formation within a tube that impairs its operation, or shortens its life, or both. This is the deposition of foreign matter such as shells, which may cause erosion-corrosion effects, and the growth of organisms such as algae. The latter materially reduce heat transfer.

Take the case of the Newport Electric Corporation, Newport, R.I. Its condensers are cooled by harbor water, with the result that algae and other marine organisms coat the tubes, reducing efficiency, lowering the vacuum, and increasing fuel consumption.

This utility is exceptionally well managed, with a systematic tube-cleaning program. However, it found that brushes and rubber plugs used for cleaning wore out quickly. Revere took a close interest in this problem. One of Revere's customers makes nylon brushes for cleaning tubes in dairies, and it was suggested that a modification of these be tried. Results: over 300 tubes cleaned per brush, a much longer life than anything previously used, and a half-inch gain in vacuum, meaning dollars and cents saved in fuel.

Revere makes condenser tubes and plates in all the usual alloys, and is glad to collaborate not only in specification, but in other condenser problems, as this case history shows. We are only too glad to work with you on any matter involving condenser and heat exchanger operation. Our wide experience, and contacts with many industries will be made freely available to you. Write the nearest Revere office.

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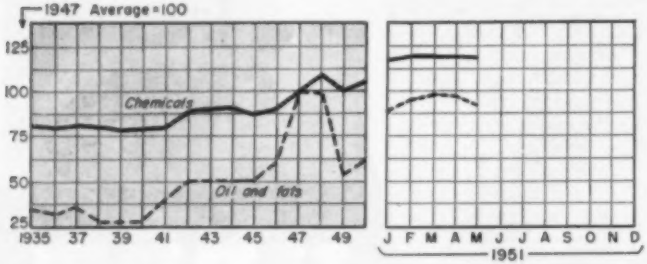
Process Industry Trends

PRICES

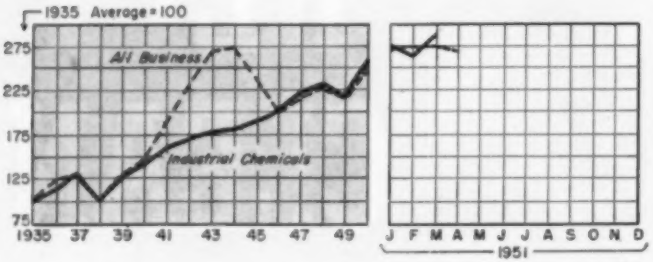


Chemical Engineering's Price Indexes

Chemicals – Down 0.14
Fats & Oils – Down 9.69

	Chemicals	Oils & Fats
As of June 1	118.97	83.50
Last month	119.11	93.19
June 1950	100.32	56.45
June 1949	99.90	52.76

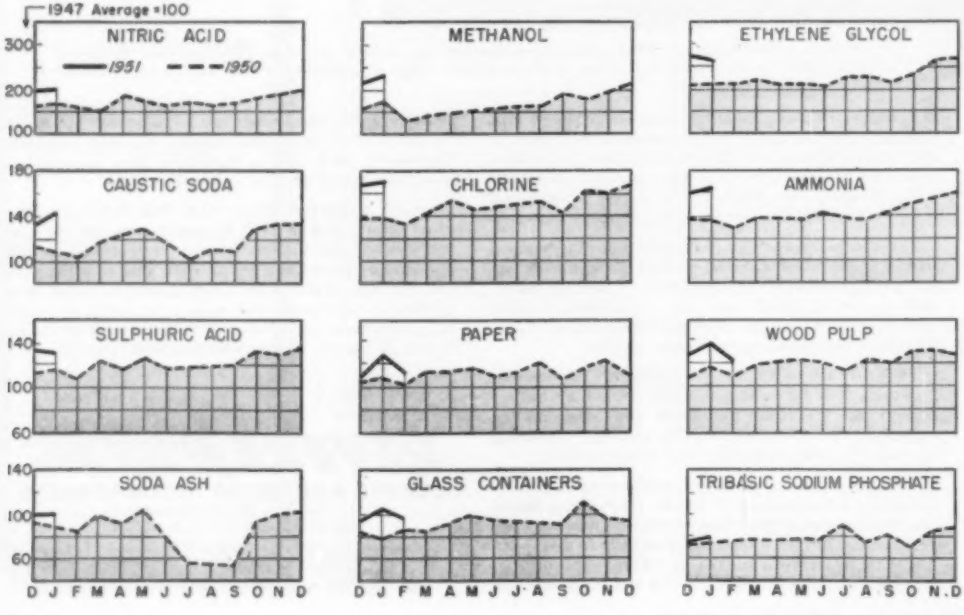
CONSUMPTION



Industrial Chemicals Index

	February (Revised)	March
Fertilizers	58.30	66.10
Pulp and paper	27.50	30.60
Petroleum refining	23.40	26.10
Iron and steel	14.25	16.55
Rayon	31.65	32.20
Glass	21.55	24.85
Paint and varnish	28.80	31.05
Textiles	12.67	12.70
Coal products	9.90	11.30
Leather	4.89	4.91
Explosives	7.22	7.87
Rubber	5.55	6.28
Plastics	14.26	17.15
INDEX	259.94	287.66

PRODUCTION



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IRON pipe failed in only a few months under attack from hot brine solution in the refinery of the United States Potash Company.

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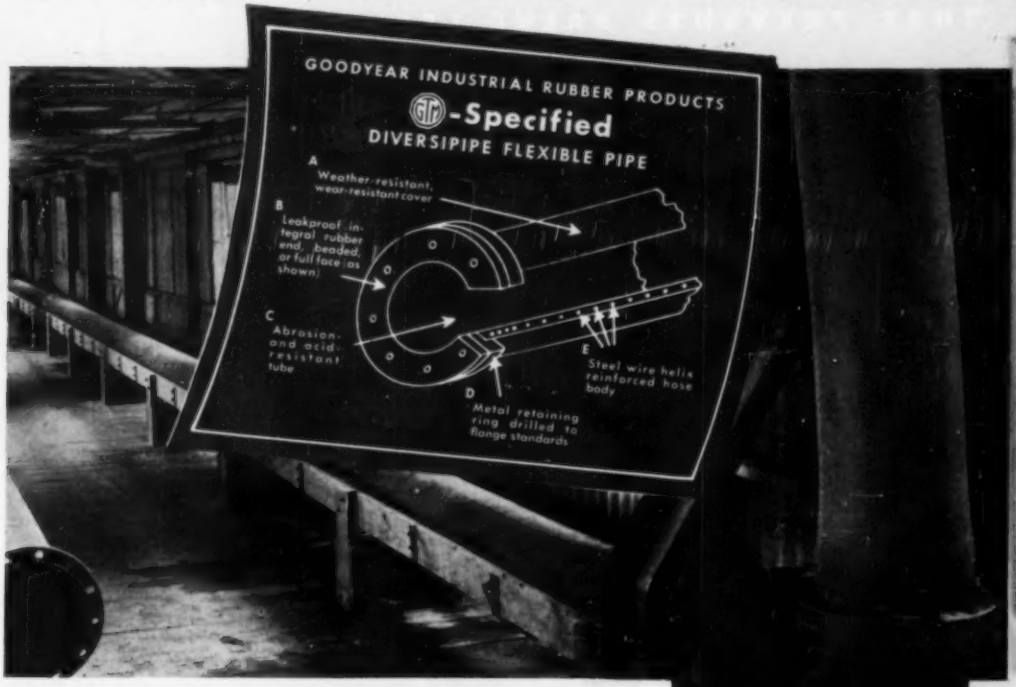

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THAT PREVENTS VALVE LEAKAGE

The ports are surrounded by an impassable barrier of pressurized lubricant

You can't see what's going on inside of a valve when you operate it. But you want to know with certainty that you have a complete, positive closure. If a valve seat is exposed to the line or you have to guess if discs are tightly seated you can't be absolutely sure of a leakproof shut-off. But in any Nordstrom valve, the seat is *never exposed*. Rotation of the plug a quarter turn slides the plug ports shut. A pressurized seal of lubricant surrounds each port to prevent leakage. *Keep upkeep down.*

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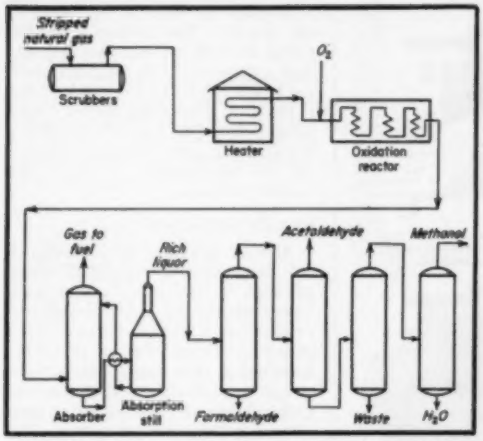
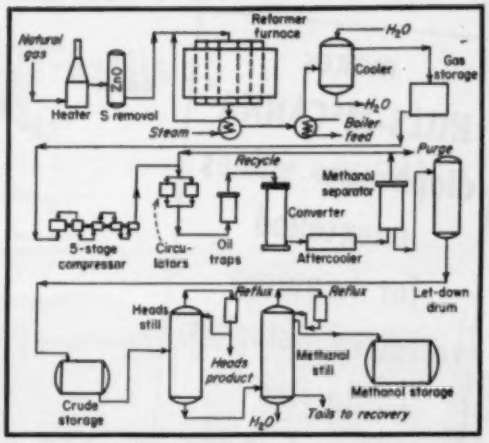


Some units turn out methanol as one of several coproducts.



Modern units like this can produce methanol or ammonia.

Methanol Today

Methanol's popularity is keeping producers busy. Larger markets loom. More and more is coming from natural gas. Coke is losing ground.

Today synthetic methanol is being produced by two major processes. They are: (1) reaction of carbon monoxide and hydrogen, (2) oxidation of selected fractions of natural gas or propane and butane.

CO PLUS H_2

Reaction of carbon monoxide and hydrogen may be carried out in plants using coke or natural gas as raw materials. The majority of these plants use natural gas. In fact, Solvay at South Point, Ohio, is the only major methanol producing unit running on coke.

Here is the method followed in a typical CO plus H_2 plant. Natural gas, high in methane, is piped into the plant and heated. This is run through a tower containing zinc oxide. The zinc oxide reacts with any sulphur present to form zinc sulphide.

The gas is then passed to a reformer furnace where it is mixed with steam. The mixture passes over a nickel catalyst in the gas fired furnace and the reformed gas (CO plus H_2) next flows to a superheater and then a boiler feedwater heater. From the water heater it passes into a cooling tower. The cooled gases are next moved to a storage tank.

In some plants carbon dioxide from adjoining operations is introduced in the cooling tower to give a quenching effect in the converter and to aid in controlling the reaction. However, this has the disadvantage of making 80 percent methanol as compared with 95 percent product when carbon monoxide is used alone.

From the storage tank the gas is passed to a compressor. Here the pressure is raised in several stages to about 4,400 psig. The compressed gas runs through recirculators and oil traps and then enters the converter. In the converter the gas passes through catalyst beds and then travels to a cascade cooler. In the converter, temperatures may range from 250 deg. C. to 400 deg. C. and pressures may run from 2,200 to 14,700 psig. depending on the plant. In general, the yields improve with increased pressure and decrease with higher temperatures.

After the methanol has passed through the cooler it travels through a separator. Unreacted gases are recycled to the circulators and the methanol goes to a let-down drum. After flowing into a storage tank it is distilled and the product is stored or shipped.

BUTANE-PROPANE OXIDATION

Of the two methods used in oxidizing products of natural or petroleum gases, Celanese Corp. uses the following technique. The hydrocarbons are compressed and pushed to the reaction furnace where air is used to oxidize the feed stream. The oxidation equipment is designed so that propane, butane or a mixture can be oxidized as desired. In the oxidation step the pressure and temperature as

(*Continued*)

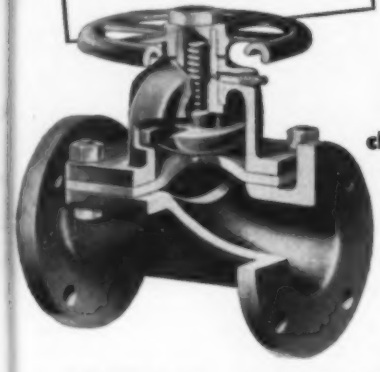
Synthetic Methanol Producers

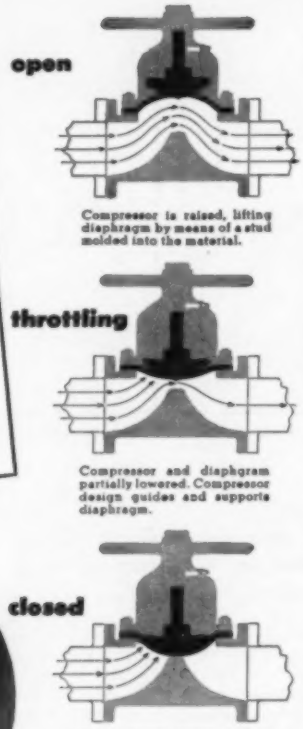
Company	Location	Process	Capacity Million Gal./Yr.
Celanese Corp. of America	Bishop, Tex.	Propane-butane oxidation	10
Cities Service Oil Co.	Tallant, Okla.	Natural gas oxidation	6
Commercial Solvents Corp.	Peoria, Ill.	CO or CO_2 + H_2	(3.8)*
	Sterlington, La.	CO or CO_2 + H_2	35
E. I. du Pont de Nemours & Co.	Belle, W. Va.	CO + H_2	(30)*
	Orange, Tex.	CO + H_2	40
Hayden Chemical Corp. (Morgantown Ordnance Works)	Morgantown, W. Va.	CO + H_2	(48)*
McCarthy Chemical Co.	Winne, Tex.	Natural gas oxidation	(5)*
Solvay Process Division, Allied Chemical & Dye Corp.	South Point, Ohio	CO + H_2	18
Spencer Chemical Co.	Military, Kan.	CO + H_2	10
Union Carbide & Carbon Corp.	Texas City, Tex.	CO + H_2	18
	South Charleston, W. Va.	CO + H_2	12
	Niagara Falls, N. Y.	CO + H_2	(2)*

*Not operating.

This Simple Principle

makes HILLS-McCANNA diaphragm valves unexcelled for handling corrosive materials, slurries and semi-solids




open
Compressor is raised, lifting diaphragm by means of a stud molded into the material.
throttling
Compressor and diaphragm partially lowered. Compressor design guides and supports diaphragm.
closed
Compressor presses diaphragm tightly against weir pinching off flow and making a tight seal.

• When it comes to valving hard-to-handle fluids, the simple pinch clamp principle of Hills-McCanna valves (see above) eliminates most ordinary valve troubles. There is no leakage, no packing and material handled cannot contaminate or be contaminated by the working parts. Hills-McCanna Saunders patent diaphragm valves are the answer to many of the most serious valve problems. Write for full details and ask for a copy of Catalog V-48. HILLS-McCANNA CO. 2341 W. Nelson Street, Chicago 18, Illinois.

FOR 66° Bé SULPHURIC
Hills-McCanna now offers new plastic diaphragms for handling 66° Bé sulphuric. Write for details.

HILLS-McCANNA
saunders patent
diaphragm valves
Also manufacturers of Proportioning Pumps
Force Feed Lubricators • Magnesium Alloy Castings

well as the concentrations are controlled to permit a selected yield of products. Most of the finished chemicals are actually formed in the oxidation unit. Methanol is formed along with other products at this stage of the process. The methanol fraction passes through coolers, absorbers and then a separator. The oxidized crude mixture is stored in a tank which feeds a series of distillation towers. After passing through two towers where acetaldehyde and acetone are distilled off, the methanol is cut out of the alcohol mixture.

OXIDATION OF NATURAL GAS

Another technique produces methanol. Some plants use a stripped natural gas high in methane. In such units heated natural gas is compressed and oxidized in a reactor furnace under proper conditions after air or O_2 has been added. The reactor products are passed to an absorber. Water is used as the absorbent. The remaining gases enter a gas distribution system. The water solution is stripped of chemicals in a still. The chemicals pass on to a series of bubble-cap towers where methanol is separated from the other products.

PRODUCTION COSTS

Production costs of methanol will vary widely depending on the bookkeeping methods employed at each producing plant. However, *Chemical Engineering* has made some estimates on the cost of a typical CO plus H_2 unit that might be built today. These figures do not represent any particular plant. They only show the relative distribution of various factors involved in determining the price of the product. This computation is based on delivery in the vicinity of the plant.

How Methanol Price Is Figured

	$ per Gal.
Natural gas	$0.020
Other mat'ls	0.003
Operating cost	0.035
Depreciation	0.080
Producing cost	0.138
Sale price	0.320
Margin	0.182
Fed. income tax	0.087
Net profit	$0.095

This analysis assumes no freight charge and this of course would shave the margin even more. Based on the above computation (amortization was figured at 10 percent or 80c. per annual gal.) the return on investment of methanol operations comes to 11 percent. These figures indicate that methanol is no lush profit item but is a fairly stable income producer. In considering these costs, it must be remem-

bered that the existing units were built when plant costs were lower and the amortization factor will therefore be smaller. Another factor that would reduce costs is the lower raw material costs that result from the long-term contracts for natural gas and other materials.

END-USE PATTERN

There are several complicating factors in considering the future of methanol growth. One of these is the end use pattern that has been built up since World War II. This is the estimate use pattern for 1951.

Use	Percent
Formaldehyde	40
Anti-freeze	35
Methylacrylates	11
Solvent uses	4
Pharmaceuticals	2
Detergents	1
Methyl chloride	2
Other chemicals	2
Misc.	3
Total	100

Most of the major uses of methanol are well known and represent stable markets. A big factor in the growth of methanol in the future is buried in the miscellaneous bracket in 1951. This is the use of methanol in fuel. According to some industry experts this market will become quite sizable in the future although it take only a fraction of one percent at the present time. Methylacrylate use is also growing. Any large growth in formaldehyde's consumption of methanol will probably come from expanding demand for pentarythritol and hexamine. Penta's main non-military use will be found in alkyd resins.

Methanol competes: (1) with ethyl alcohol in the antifreeze market where fluctuating prices have a big effect on the relative requirements of methanol, ethanol, isopropanol and ethylene glycol, (2) with isopropanol for general solvent uses and (3) with acetone in paint removers as well as in some paints and varnishes.

PRODUCTION

In the past ten years methanol production has come primarily from synthetic plants. (Production of natural methanol amounts to only a little over 2 million gallons per year.) In 1941, synthetic methanol manufacture was 55,847,000 gal. By 1945 output was up to 74,300,000 gal. per year. By 1948 production jumped to 150,000,000 gal. It slipped down to 126,000,000 gal. in 1949 and rose to 136,000,000 gal. in 1950. This year synthetic production should climb to 160,000,000 gal. It will probably reach 200,000,000 by 1953.

Celanese is currently building two new Chemcel type units. One is at Edmonton, Alberta. The other is at Pampa, Tex.

Readco Laboratory Mixers are Versatile . . .

. . . where versatility counts!

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Built in 1, 3 and 6 quart working capacities.

Readco Laboratory Mixers enable you to handle a variety of materials . . . easily and efficiently. Interchangeable arms adapt them to many types of laboratory use, enabling you to make accurate predictions for commercial production.

Rugged Readco Laboratory Mixers are quickly disassembled for cleaning. Split packing glands permit easy replacement of shaft packing. Reversible geared head motors provide forward and reverse, overlapping mixing action. Large bowl trunnions support the bowl, assuring permanent alignment. *Read Standard Corporation, Bakery • Chemical Division, York, Pennsylvania.*

FORMERLY Read Machinery Division of The Standard Stoker Company, Inc. ONLY THE NAME HAS CHANGED.

READ STANDARD CORPORATION

New Construction

Proposed Work

Calif., Fontana—Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa., plans to construct a roofing materials and pipe enameling plant here. Estimated cost $5,000,000

Ga., Valdosta—National Container Co., Borden Ave. and Review St., Long Island City, N. Y., plans to construct a kraft board pulp and paper plant here. Estimated cost $25,000,000

Kan., Ulysses—Stanolind Oil & Gas Co., Wichita, plans to construct a natural gasoline plant here. Estimated cost $2,750,000

La., Baton Rouge—Naugatuck Chemical Co., Baton Rouge, plans to construct a plant addition. Estimated cost $2,000,000

Mich., Manistee—Hooker Electro-Chemical Co., Niagara Falls, N. Y., plans to construct a plant here. Estimated cost $7,000,000

N. M., Eunice—Skelly Oil Co., Skelly Bldg., Tulsa, Okla., plans to enlarge gasoline plants Nos. 1 and 2. Estimated cost $1,250,000 and $1,000,000 respectively.

O., Gibsonburg—Kelley Island Lime & Transport Co., Leader Bldg., Cleveland, plans to construct dolomite process works. John F. Meissner, Inc., 308 West Washington St., Chicago, Ill., Consult. Engr. Estimated cost $1,200,000

O., Rossford—Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo, plans to construct a factory to produce precision plate glass. Estimated cost $14,183,000

O., Toledo—Standard Oil Co. of Ohio, Midland Bldg., Cleveland, plans to construct a catlytic cracking unit at refinery on Cedar Point Rd. Estimated cost $9,000,000

Contracts Awarded

Ala., Birmingham—American Vitrified Products Co., National City Bank Bldg., Cleveland, O., will construct a plant here with own forces. Estimated cost $500,000

Ill., North Chicago—Abbott Laboratories, Inc., 14th and Sheridan Sts., has awarded the contract for a pharmaceutical laboratory building to Carroll Construction Co., 333 North Michigan Ave., Chicago. Estimated cost $500,000

Kan., Holcomb—Kansas-Nebraska Natural Gas Co., Inc., Phillipsburg, Kan., will construct a 44,000,000 cu. ft. dehydration plant and a compressor station. Work will be done with own forces. Estimated cost $875,000

Ky., Louisville—Standard Oil Co. of Kentucky, 5th and Bloom Sts., has awarded the contract for warehouses to Geo. H. Rommel Co., 958 Logan St. Estimated cost $428,000

La., Baton Rouge—Consolidated Chemical Industries, Inc., c/o Ralph M. Parsons Co., 617 South Olive St., Los Angeles, Calif., contractor, will construct a sulphur recovery plant here. Estimated cost $500,000

	Current Projects		Cumulative 1951	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$150,000	.....	$565,000
Middle Atlantic	.....	3,852,000	$1,500,000	49,636,000
South	$4,500,000	2,128,000	76,811,000	*194,400,000
Middle West	31,383,000	19,164,000	59,008,000	73,769,000
West of Mississippi	5,000,000	26,597,000	149,267,000	256,170,000
Far West	5,000,000	10,275,000	20,750,000	20,254,000
Canada	.....	.....	135,062,000	43,336,000
Total	$45,883,000	$62,166,000	$442,398,000	$642,130,000

*Revised

La., Southport—International Lubricant Corp., Southport, has awarded the contract for a compounding plant to Pittman Contracting Co., 2925 Franklin Ave., New Orleans. Estimated cost $200,000

Mass., Beverly—Bomac Laboratories, Inc., 96 Park Ave., has awarded the contract for a laboratory to John Clemenzi & Sons, 110 Elliott St. Estimated cost $150,000

Mich., Edmore—Carboloy Co., Inc., 11177 East 8 Mile Rd., Detroit, has awarded the contract for a plant to process tungsten carbide to Miller Davis Co., Kalamazoo, Mich. Estimated cost $2,000,000

Mich., Filer City—American Box Board Co., 5950 West 51st St., Chicago, Ill., has awarded the contract for a paper manufacturing plant here to Sumner-Sollitt Co., 307 North Michigan Ave., Chicago. Estimated cost $7,500,000

Mich., Wyandotte—Wyandotte Chemicals Corp., Wyandotte, has awarded the contract for alterations and additions to its plant to Charlson Co., Lycast St. Estimated cost $2,500,000

Mo., Sugar Creek—Missouri Portland Cement Co., 3615 Olive St., St. Louis, has awarded the contract for additions to its plant including new "push button" plant to MacDonald Engineering Co., 188 West Randolph St., Chicago, Ill. Estimated cost will exceed $1,000,000

N. J., Nutley—Hoffman-LaRoche, Inc., Nutley, has awarded the contract for a pharmaceuticals plant to Wigton-Abbott Corp., 1225 South Ave., Plainfield. Estimated cost $150,000

N. Y., Forest Hills—McKesson & Robbins, Inc., 155 East 44th St., New York, N. Y., has awarded the contract for a warehouse at Metropolitan Ave. and Trotting Course Lane, to W. J. Barney Corp., 101 Park Ave., New York, at $702,500

N. Y., Jamesville—Alpha Portland Cement Co., Easton, Pa., has awarded the contract for a cement plant here to MacDonald Engineering Co., 188 West Randolph St., Chicago, Ill. Estimated cost $3,000,000

N. C., Burlington—Celanese Corp. of America, 180 Madison Ave., New York, N. Y., has awarded the contract for a plant addition here to Hughes-Foulkrod Co., 56th St. and Upland Way, Philadelphia. Estimated cost $500,000

O., Barberton—Southern Alkali Co., Columbia Court, has awarded the contract for enlarging its plant to Heller-Murray Co., 222 West Rayen Ave., Youngstown. Estimated cost between $4,000,000 and $5,000,000

O., Rossford—General Mills, General Mills Bldg., Minneapolis, Minn., has awarded the contract for a soy bean processing plant to Blaw-Knox Corp., Farmers Bank Bldg., Pittsburgh, Pa. Estimated cost $2,000,000

Tex., Bishop—Celanese Corp. of America, Bishop, will construct an addition to its chemical plant here. Work will be done with own forces. Estimated cost $3,502,000

Tex., Houston—Shell Oil Co., Inc., Shell Bldg., has awarded the contract for enlarging its refinery on LaPorte Rd. to manufacture chemicals used in the manufacture of aviation gasoline and jet fuels, to Procon, Inc., (subsidiary of Universal Oil Products Co., 310 South Michigan Ave., Chicago, Ill.). Estimated cost $12,000,000

Tex., Houston—Diamond Alkali Co., 1006 Main St., has awarded the contract for chlorine and caustic plant to Brown & Root, Inc., Box 3; laboratory to R. E. Nesmith, Long Dr. Estimated cost $2,750,000 and $145,000 respectively.

Tex., Houston—Goodyear Synthetic Rubber Corp., LaPorte Rd., has awarded the contract for alterations to its rubber plant to Tellepson Construction Co., 1710 Telephone Rd. Estimated cost $375,000

Tex., Odessa—Odessa Natural Gasoline Co. and Sid Richardson Carbon Co., Odessa, will construct a sulphur plant. Work will be done by owners. Estimated cost $200,000

Tex., Pampa—Celanese Corp. of America, 180 Madison Ave., New York, N. Y. Has awarded the contract for a chemical plant to Brown & Root, Inc., Box 3, Houston. Estimated cost $5,750,000

Utah, Woods Cross—Phillips Petroleum Co., Bartlesville, Okla., has awarded the contract for an 8,000 bbl. catalytic cracking plant to Fluor Corp., 360 East 2nd St., Los Angeles, Calif. Estimated cost $10,000,000

Wash., Tacoma—St. Regis Paper Co., 801 Canal St., will expand its boiler plant and construct chip storage and recovery plant facilities at its mill. Work will be done with day labor. Estimated cost $275,000

Wis., Green Bay—Bay West Paper Co., 345 South Pearl St., has awarded the contract for a 1 story 50,000 sq. ft. factory to Selmer Co., Northern Bldg.

Wis., Sheboygan—Plastics Engineering Co., 1607 Geele Ave., has awarded the contract for a 2 story, 80x90 ft. factory to Rammer Construction Co., Route 3.

IN THIS 32-PAGE BULLETIN YOU WILL FIND an outline of the latest improvements in calender design . . . general specifications, which indicate the many possible variations in construction . . . diagrams showing roll arrangements for a number of different applications . . . illustrations of various calenders with captions explaining their applications and special features . . . details of the latest Z-type calenders, developed by Farrel-Birmingham to provide the extreme accuracy required in high-speed calendering of plastic film and some rubber products . . . parts lists for three-roll and four-roll calenders . . . and a description of the company's "Specialized Engineering Service."

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Typical? Yes—typical of thousands of such reports thoughout the country.

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ENGINEERING News

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SK ROTAMETERS APPLY CONTINUOUS PROCESS PRINCIPLES IN BATCH OPERATIONS

SK Rotameters have long been employed profitably in continuous process operations for indicating, recording, integrating and controlling fluid flow by using electrical and mechanical control instruments in conjunction with the Rotameter. This method of fluid measurement and control has proved highly efficient in continuous process due to the accuracy of the Rotameter, and its simple maintenance as compared with orifices and mercury filled differential head meters.

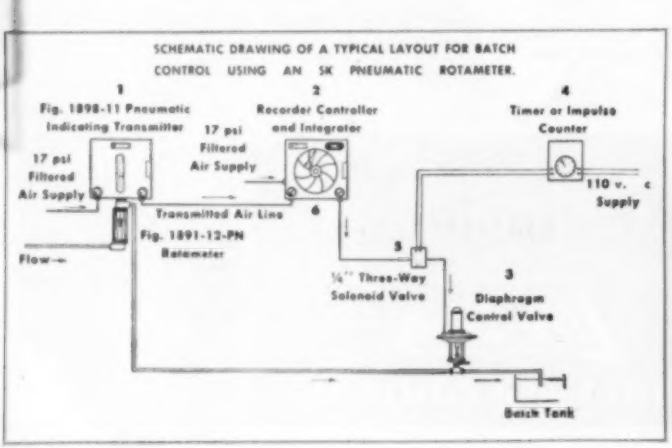
Now, with a minimum of additional equipment, SK engineers can apply the Rotameter control circuit to *batch process* installations for automatic, carefully-measured operation requiring minimum supervision and maintenance.

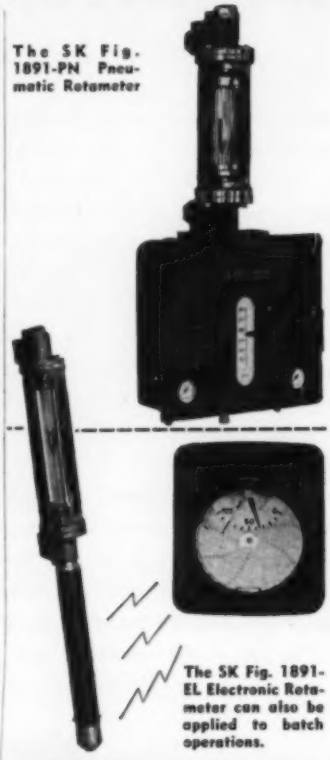
The flow diagram illustrated shows a typical layout for batch control with SK Rotameters. Many modifications of this instrumentation are possible so that it can be adapted for automatic control of practically any type of batch process. In this instance, the SK Rotameter with Pneumatic Transmitter (1) measures the rate of flow in the feed line to the batch tank and sets the pen of the Integrating Recorder Controller (2) accordingly. The Pneumatic Controller in this instrument keeps the rate of flow in the feed line constant by means of the Diaphragm Control Valve (3). The electrically operated integrator in the Recorder Controller (2) is connected electrically with the Electric Timer or Impulse Counter (4) whose scale, graduated in volume or weight units, can be set to a predetermined value required for the batch. When this amount of fluid has passed into the batch tank the Timer (4) closes the Solenoid Valve (5) in the air line connecting the out-put of the pneumatic control mechanism in the Recorder Controller (2) with the Control Valve (3) which in turn shuts off the flow to the batch tank.

In this manner, the amount of fluid required for the batch process is accurately and automatically kept at a predetermined value which can be varied according to requirements. At the same time the integrator in the Recorded Controller (2) indicates the total amount of material consumed for any number of individual batches.

This SK Rotameter control circuit is in successful operation in a large Eastern batch processing plant, daily lowering cost through automatic control and decreasing product rejection by accurate measurement.

If you have a batch control problem, write, giving us the facts. We may be able to help you.





The SK Fig. 1891-PN Pneumatic Rotameter

The SK Fig. 1891-EL Electronic Rotameter can also be applied to batch operations.

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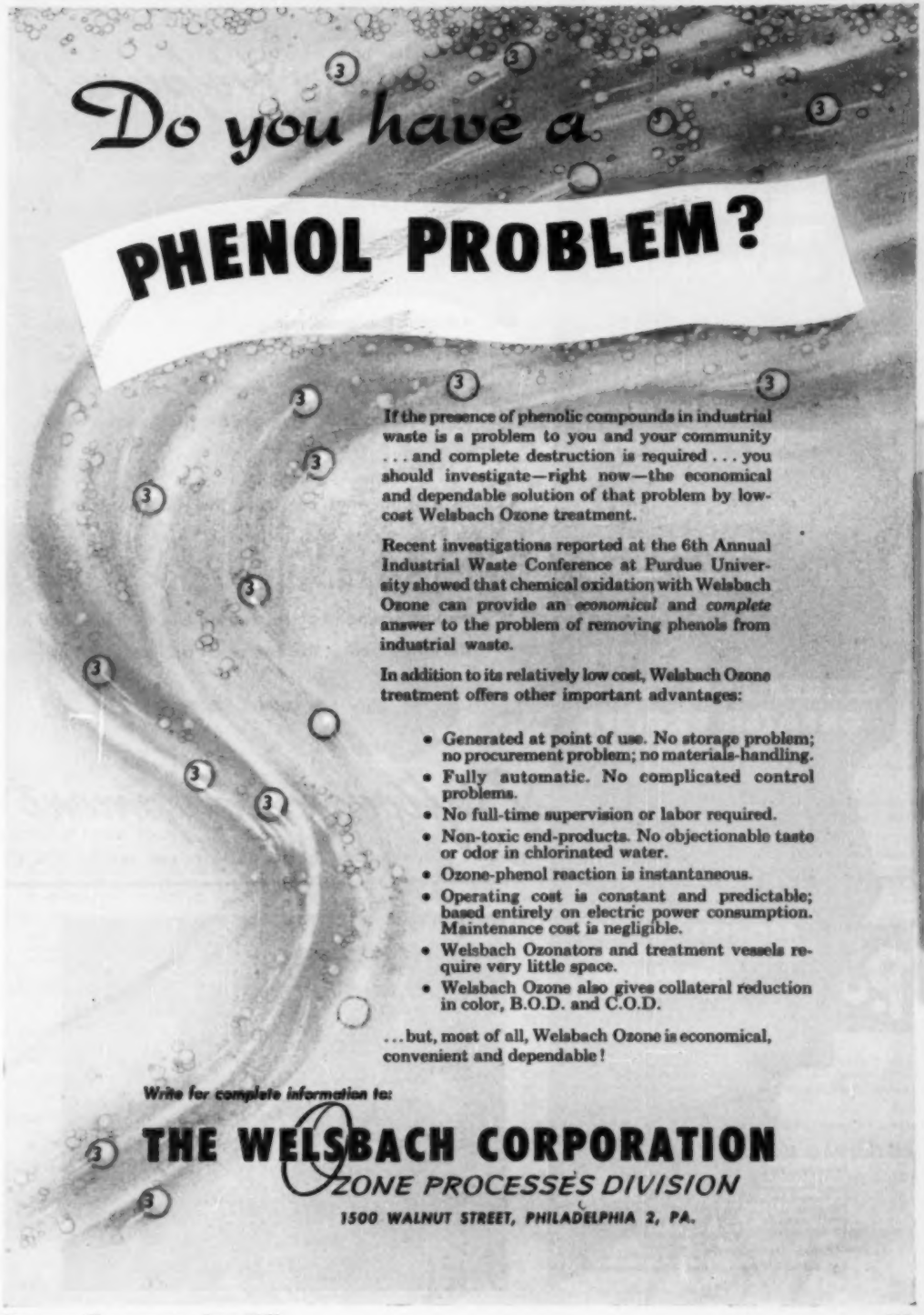

If the presence of phenolic compounds in industrial waste is a problem to you and your community . . . and complete destruction is required . . . you should investigate—right now—the economical and dependable solution of that problem by low-cost Welsbach Ozone treatment.

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- Operating cost is constant and predictable; based entirely on electric power consumption. Maintenance cost is negligible.
- Welsbach Ozonators and treatment vessels require very little space.
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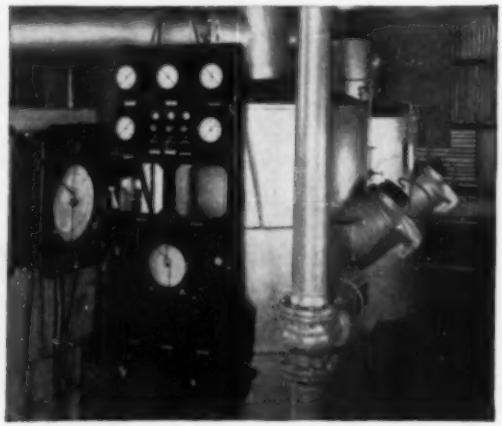

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AC to DC, AC to AC
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Ball Bearing motors are factory lubricated for several years' normal service. Bearing housing construction permits easy re-lubrication when unusual service demands it.

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To guard your production against the destructive effects of atmospheric hazards, Century offers four types of protective motor frames.

DRIP PROOF—meets the requirements of most installations. Use it where operating conditions are relatively clean and dry. Top half of the frame is enclosed to keep out falling solids and dripping liquids.

SPLASH PROOF—keeps splashing liquids out of the motor even when the frame is washed with the full force of a hose. Use Century Splash Proof motors indoors or outdoors.

TOTALLY ENCLOSED FAN COOLED—resists the hazards of abnormal concentrations of dusts, powders, grit, oil mists, acid and alkali fumes.

EXPLOSION PROOF—protects life and property in atmospheres charged with explosive dusts or vapors.

The properly selected protection with the wide variation of starting torque characteristics to choose from provides long operating life and improves the production of the driven equipment.

Century motors are available in a wide range of kinds and types—in sizes from ½ to 400 horsepower—for single phase, polyphase and direct current applications.

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Westinghouse PRECIPITRON, the electronic air cleaner, has long been used where clean air is a *must*. Its wide acceptance is due to three factors: (1) its design—*invented* by Westinghouse and developed through years of engineering and application experience; (2) its efficiency—*three times* more efficient than the *best* mechanical air cleaner; (3) its dependability—proved by countless installations.

In chemical plants, *product* or *process* contamination caused by airborne dirt and foreign matter is eliminated by PRECIPITRON. Circulating air for small enclosures or for large areas of your plant or office buildings can be made free of dust, dirt, pollen, and soot.

NOW, Westinghouse announces a new model which incorporates all the features of the standard line, and adds the convenience and money-saving advantages of a factory-designed, factory-matched *encased* unit.

HERE'S WHAT IT MEANS TO YOU:

Material Procurement Reduced. Everything you need is provided . . . no searching for scarce parts or supplies, or resorting to substitutes . . . 18-gauge casing and 10-gauge tank of galvanized steel assure rigidity; entering side baffles provide proper air distribution.

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Masonry Work Reduced or Eliminated. Drain tank for flushing away collected dirt lays into place and unit bolts to it . . . range of 24 sizes from 8' x 5' x 5' to 8' x 10' x 11' permits matching to the job.

Saves Time and Manpower. Prefabricated parts, factory-matched, save assembly time and assure proper installation . . . highly skilled labor not required.

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PUTTING *Air* TO WORK

NO WEAR FROM LINE FLUID

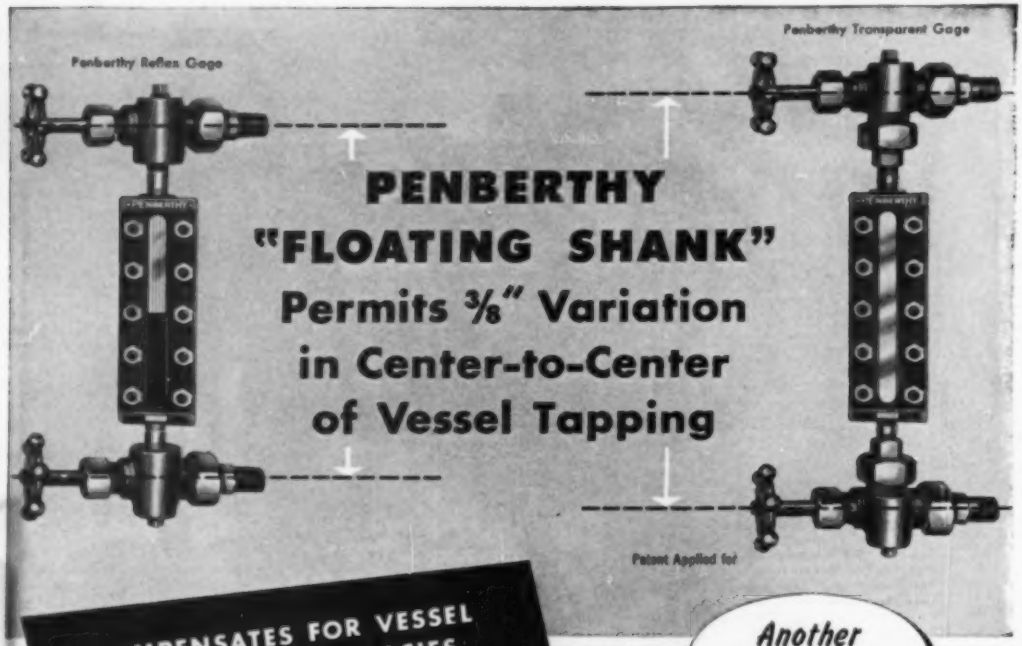
Bank of 8" a.c.f. Lubricated Plug Valves at the East Texas Salt Water Disposal Company's Cook Plant, Turnerstown, Texas.

Why risk the erosive effects of flowing fluid? Actual seating and sealing surfaces of the a.c.f. Lubricated CYLINDRICAL PLUG Valve are sealed away and protected when the valve is on flow. The result is longer service life, no replacement of parts.

a.c.f. CYLINDRICAL FULL PIPE AREA PLUG VALVES

Representatives in 50 Principal Cities

Ask for Catalog 4CM. American Car and Foundry Company, Valve Division, 1501 East Ferry Ave., Detroit 11, Michigan



PENBERTHY "FLOATING SHANK" Permits 3/8" Variation in Center-to-Center of Vessel Tapping

COMPENSATES FOR VESSEL TAPPING INACCURACIES

•

SAVES INSTALLATION TIME

•

REDUCES GAGE STRESSES

Another **PENBERTHY** *First*

An important new feature now available on all Penberthy drop forged steel gage valves is the "floating shank" . . . an improvement that has money-saving advantages to many users of liquid level and water gages.

The "floating shank" compensates for inaccuracies in the center-to-center distance of the tapped holes in the vessel on which the gage is mounted. The variation can be as much as 3/8". It provides a mounting flexibility not elsewhere obtainable . . . it saves time during installation of the gage . . . it eliminates stresses that are often induced during mounting.

The Penberthy "Floating Shank" can be had at slight additional cost . . . specify it on your next order for Penberthy drop forged steel (or alloy) gage valves.

4449

PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

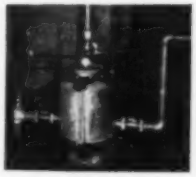
Detroit 2, Michigan

Established 1886 — *Canadian Plant, Windsor, Ontario*

OTHER PENBERTHY PRODUCTS

PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



PENBERTHY EXPLOSION-PROOF SUMP PUMPS

Motor and switch totally enclosed. Underwriter approved for Class I, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.

PENBERTHY EJECTORS

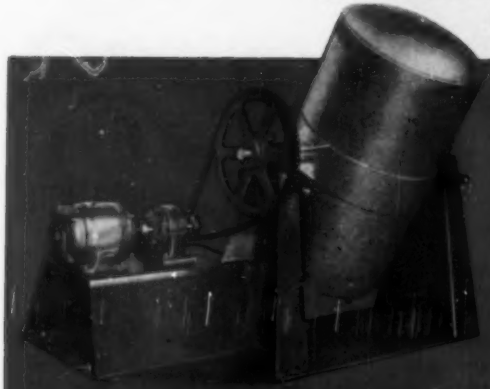
A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Ask for Bulletin 5080.

BACK IN THE 1880's

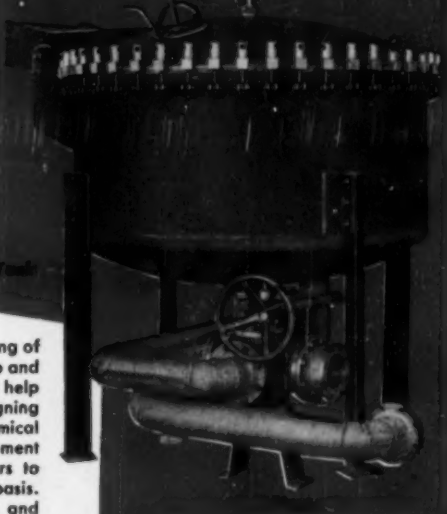
WHEN THE FIRST NEW YORK TO CHICAGO TELEPHONE COMMUNICATION WAS OPENED

Koven

WAS MAKING INDIVIDUALIZED CHEMICAL EQUIPMENT

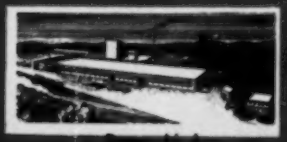


30" x 48" Tumbling Barrel—Galvanized



Stainless Steel Dye Tank

Commerce received a great impetus with the opening of the first telephone communication between Chicago and New York. At the same time, KOVEN was proud to help in the expansion of the chemical industry by designing equipment to meet the individual needs of chemical manufacturers. Today KOVEN Individualized equipment is enabling many leading chemical manufacturers to operate on a more productive and economical basis. Our skilled engineers can help you reduce costs and increase production in your plants by fabricating more efficient, speedier equipment individually designed for your specific requirements. Our two huge plants are ready to serve you with fast modern facilities which include: machine, sheet and plate, welding and galvanizing shops, X-ray equipment and stress relieving furnace. Call or write today for a consultation with a KOVEN representative—no obligation.



KOVEN equipment in all commercial metals and alloys includes: pressure vessels, extractors, mixers, stills, condensers, kettles, tanks, chutes, containers, stacks, coils. Fabrication to A.S.M.E. Code par. U-68 and U-69 a specialty.

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KOVEN FOR INDIVIDUALIZED CHEMICAL EQUIPMENT SINCE 1881

PICCO Synthetic RESINS

Dependably serving a wide variety of industries and applications

PICCOLYTE

A pure hydrocarbon, pale, non-yellowing, thermoplastic terpene resin that is low in cost, soluble in low cost naphthas, chemically inert, compatible with waxes, resins, paint and varnish oils and many other materials. Available in nine melting points.

PICCOUMARON

A series of thermoplastic para-coumarone indene resins, soluble in coal tar, turpentine, terpene and most chlorinated solvents. Ten melting points, from liquid to a brittle solid. Inert to all except strong concentrated acids.

PICCOLASTIC

Made in six types and seven melting points, from 5° C. to 150° C. Pale in color, Piccolastic Resins are unsaponifiable, stable in package, body and film, soluble in low-cost solvents, acid and alkali resistant. Permanently thermoplastic.

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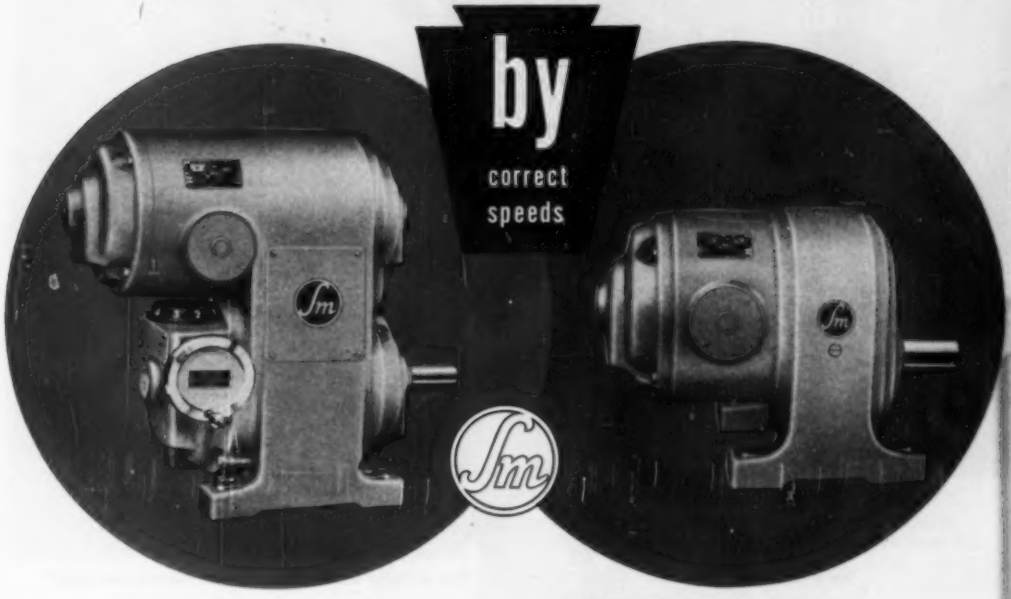
Clairton, Pennsylvania

Plants at
CLAIRTON, PA.; WEST ELIZABETH, PA.; and CHESTER, PA.
Distributed by Pennsylvania Falk Chemical Co., Pittsburgh 30, Pa. and Harwick Standard Chemical Co., Akron 5, Ohio

power modernization

conserves man power and materials...



Ask for your copy of pictorial bulletin No. **170**, showing Sterling Electric Power Drives Turning The Wheels of Industry.

STERLING **SPEED-TROL**

. . . GIVES YOU VARIABLE SPEED CONTROL NECESSARY FOR:

PROCESS CONTROL OF: Temperature—viscosity—level—pressure—flow—etc.

TIME CONTROL OF: Baking—drying—heating—cooking—pasteurizing—soaking—chemical action—etc.

EQUIPMENT ADAPTATION TO: Load variation—sequence synchronization. Size—tension—hardness or shape of materials to be processed—machined—conveyed—blended—mixed—etc.

VARIATIONS IN: Quality—quantity—operators' abilities—etc.

STERLING **SLO-SPEED**

. . . GIVES YOU THE ONE BEST SLOW SPEED AND:

gives uninterrupted service—provides versatile mounting and flexibility in arrangement of machinery—saves valuable space—provides greater safety—costs less to install and use. An indispensable source of slow speed power for:

Agitators	Cookers	Kilns	Pumps
Blenders	Dryers	Mills	Screens
Blowers	Feeders	Mixers	Tumblers
Conveyors	Filters	Presses	Etc., etc., etc.

STERLING ELECTRIC MOTORS

Plants: New York 51, N. Y.; Los Angeles 22, California; Hamilton, Canada; Santiago, Chile.

Offices and distributors in all principal cities.

He's the man who can show you the proper insulation to get maximum heat and power from each fuel dollar expended.

Here's one insulation that will save you money

EAGLE-PICHER SUPER "66" INSULATING CEMENT

Super "66" is all-purpose, rust-inhibitive, extremely adhesive insulating cement. "Springy ball" pellets don't collapse after application . . . give great coverage, retain their thermal efficiency. 100 lbs. covers 65 sq. ft.—1 inch thick! Easily applied with trowel, over flat and irregular surfaces. Efficient for temperatures up to 1800°F. Reclaimable when used on equipment whose temperatures do not exceed 1200°F.!

An Eagle-Picher Industrial Insulation distributor or representative can help you reduce operating expenses because he has available a wide line of insulation products—for high and low temperatures—scientifically designed for maximum thermal efficiency, and practical application. Why not let him give you more information about some of the products listed here?

These Eagle-Picher products can save you money . . . power . . . time

Insulating Felts • Supertemp Blocks • Blankets
Loose Wool • Pipe Covering • Stalastic • Insulseal • Insulstic
Swetchek • Finishing Cements • Insulating Cements
Fireproofing Cement • Diatomaceous Earth Blocks

THE EAGLE-PICHER COMPANY

EAGLE EP PICHER

General Offices: Cincinnati (1), Ohio

Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

Since 1843

Get maximum fuel savings and exact temperature control with these versatile, efficient insulations

For a completely effective, low-cost insulation combination, you can't beat the teamwork of Eagle-Picher Mineral Wool Blankets, Supertemp Blocks, Super "66" Insulating Cement, No. 106 Fireproofing Cement and Insulseal. They work effectively to give your equipment highest possible thermal efficiency . . . cut operating costs by saving maximum amount of fuel . . . and help to provide perfect, precise control over temperatures.

EAGLE-PICHER FIREPROOFING CEMENT

Mixed with water to form a stiff plastic mix for easy application on ribbed lath. Recommended for fireproofing structural steel columns, steel tank supports, skirts and equipment bases. Has high dry coverage of approximately 30 sq. ft. 1 inch thick per 100 pounds. Adds fire protection, patented rust-inhibitor resists corrosion. Tested by Underwriters' Laboratories, Inc.

EAGLE-PICHER MINERAL WOOL BLANKETS

These blankets satisfy the need for a convenient method of quickly and efficiently insulating flat or curved surfaces on larger types of heated equipment. Mineral wool is felted and secured between flexible metal fabric. Outstanding physical and chemical stability enables Eagle-Picher Blankets to resist water, steam, corrosive fumes and normal vibration.

EAGLE-PICHER SUPERTEMP BLOCKS

Eagle-Picher Supertemp Blocks are lightweight (approximately 16 lbs. per cu. ft.). Can be cut easily with knife or saw to fit off-shaped areas . . . they fit snugly over minor irregularities. They're strong and have high refractory value. Withstand temperatures up to 1700° F. Conductivity at 512° F. approximately 0.43 . . . all standard sizes, from 3" x 18" to 12" x 36" . . . in thicknesses from 1" to 4".

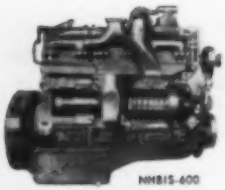
EAGLE-PICHER INSULSEAL

A tough, weatherproof, protective coating for insulation. For temperatures up to 450° F. Applied as a plastic, its smooth troweling qualities assure uniform coverage, proper thickness. It protects insulation from air infiltration, fumes, rain, snow, vibration, punctures, and withstands severe service, indoors or out. Dries to a smooth, rich black, has a neat appearance on hot or cold surfaces . . . may be washed or painted.

THE EAGLE-PICHER COMPANY General Offices: Cincinnati (1), Ohio

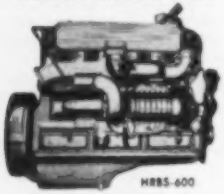
Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

EAGLE EP PICHER *Since 1843*



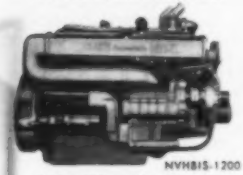
NHBIS-600

275 hp, 2100 rpm Cummins industrial Diesel. Ross lube oil cooler.



HBBS-600

225 hp, 1800 rpm Cummins automotive Diesel. Ross lube oil cooler.

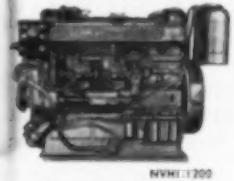


NVHBIS-1200

550 hp, 2100 rpm Cummins industrial Diesel. Ross lube oil cooler.

HRPS-601

225 hp, 1800 rpm Cummins Diesel power unit, with structural steel base. Ross lube oil cooler.



NVHI-1200

400 hp, 2100 rpm Cummins industrial Diesel. Ross lube oil cooler.

PRECISION STANDARDS OF WARRANTEED CUMMINS DIESELS DEMAND "EXTRAS" FROM COMPONENTS

more than measure up!

"Built not once but *Twice,*" is more than a slogan with Cummins. Every engine undergoes a complete rebuilding and retesting, after the first assembly has been disassembled for close inspection of all parts, following initial run-in on the test block.

This one example of the extra care and precision-workmanship that go into every Cummins Diesel is an example also of the demands which Cummins Engine Company, Inc. must necessarily make on all its components. For, in promising "the finest of engine craftsmanship, inbuilt ruggedness" and providing a warranty for one year or 100,000 miles, whichever first occurs, it's easily seen why Cummins has to be extremely prudent in its selection of so vital a component as an exchanger. *Oil and water temperatures must be closely guarded!*

So, the fact that Ross lubricating oil and jacket water coolers are utilized by Cummins is certainly conclusive proof of their dependability . . . likewise, an acknowledgment that the well known Ross qualities of thorough testing, large factor of safety, compactness and standardization jibe with the Cummins qualities of dependable profit-making performance, simplified service, interchangeability of parts and minimum downtime.

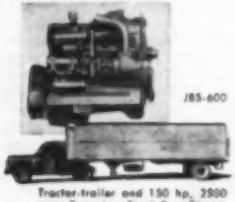
Consult Ross engineers for standardized exchangers serving engines of *any* rating. Request literature for design details.

ROSS HEATER & MFG. CO., INC.

Division of American Radiator & Standard Sanitary Corporation

1411 WEST AVENUE BUFFALO 13, N. Y.

In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

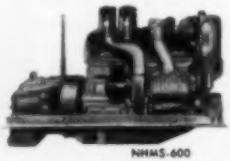


J8S-600

Tractor-trailer and 150 hp, 2800 rpm Cummins Truck-Bus Diesel. Ross lube oil cooler.

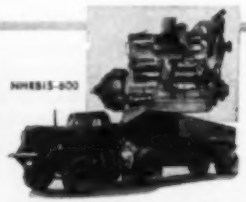
LBM-600

300 hp, 1100 rpm Cummins marine Diesel. Ross lube oil cooler.



NHMS-600

275 hp, 2100 rpm Cummins marine Diesel. Ross lube oil and jacket water coolers.



NHBIS-600

Coal hauler truck and 300 hp, 2100 rpm Cummins Diesel. Ross coolers for engine lube oil and torque converter fluid.

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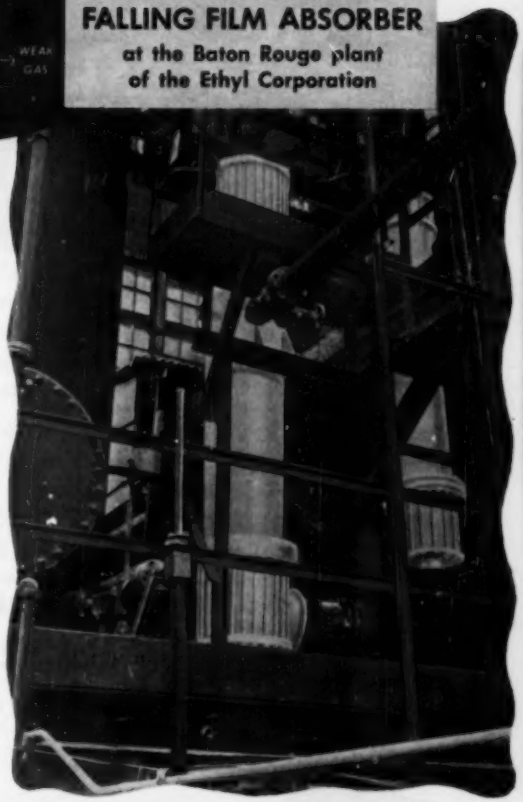
AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

HYDROCHLORIC ACID

FOSTER WHEELER FALLING FILM ABSORBER

at the Baton Rouge plant of the Ethyl Corporation



Foster Wheeler Falling Film Absorbers are proving particularly efficient for absorption of Hydrogen Chloride in weak Hydrochloric Acid.

Absorption takes place on the inside surfaces of corrosion resistant "Karbate" tubes in a cooler absorber. Since "Karbate" impervious graphite has a thermal conductivity three times that of steel the heat of absorption is efficiently transferred to cooling water. Unabsorbed HCL is scrubbed with water or dilute acid in a tails tower which feeds liquid to the cooler absorber.

For some time, four 60-tube units have been in service at the Ethyl Corporation at Baton Rouge, Louisiana. These absorbers boost 21% acid to 33% concentration for the manufacture of anhydrous HCL required in production of Tetra Ethyl Lead.

For further information, write to:

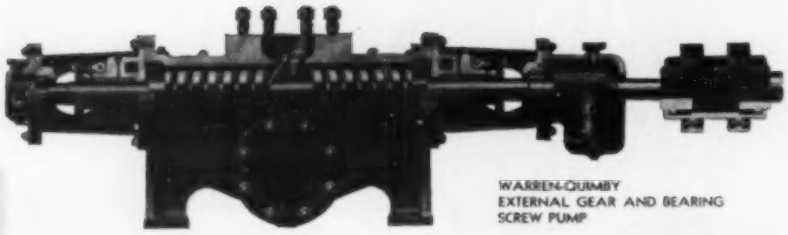
FOSTER WHEELER CORPORATION
165 BROADWAY NEW YORK 6, N. Y.

FOSTER WHEELER

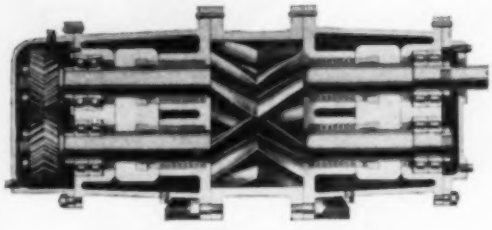
Leading engineers and builders of industrial processing equipment, chemical plants, heat exchangers, steam generators, and oil refineries.

QUIMBY doesn't Quibble

over a tough job . . . a Warren-Quimby Screw or Rotex Pump has what it takes to handle the toughest of pumping assignments in the Chemical Process field; and they accomplish it smoothly, quietly and with no pulsation.



WARREN-QUIMBY
EXTERNAL GEAR AND BEARING
SCREW PUMP



WARREN-QUIMBY ROTEX PUMP
WITH EXTERNAL GEARS

Have you a liquid handling problem involving any of the following materials?

Coal Tar Chemicals	Asphalt	Syrups and Molasses
Oils, Fats and Waxes	Fertilizers	Ceramics
Soap	Wood Products	Dyes
Petroleum Products	Brines	Paints and Varnishes
Drugs and Cosmetics	Cellulose Products	Glass
Paper and Pulp	Greases	Coal By-Products
Acetates	Distillates	Miscellaneous Chemicals

A Warren-Quimby Pump will do the job . . . and on a long-range basis, prove one of the most profitable equipment investments you ever made.

Both Screw and Rotex type pumps are available either horizontal or vertical mounted.

ROTEX · SCREW · CENTRIFUGAL · RECIPROCATING

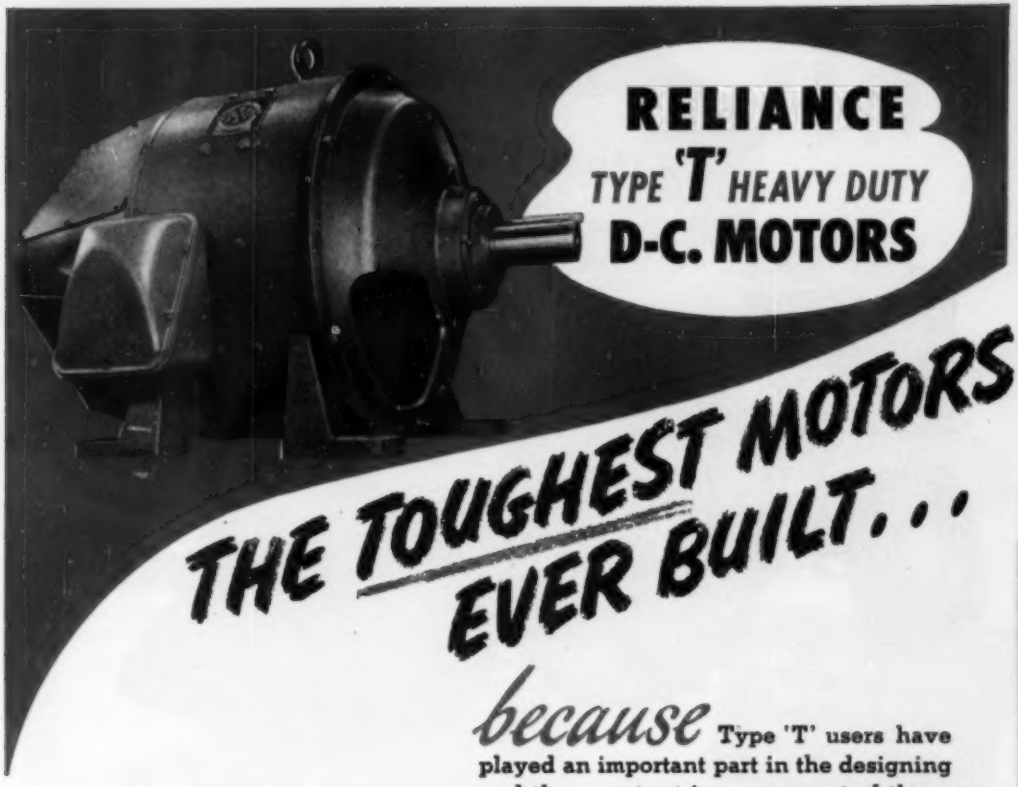
there's a Warren Pump for practically all pumping applications . . . and our complete line assures an unbiased recommendation.

WARREN QUIMBY PUMPS

CQ-3

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS



RELIANCE
TYPE 'T' HEAVY DUTY D-C. MOTORS

THE TOUGHEST MOTORS EVER BUILT...

because Type 'T' users have played an important part in the designing and the constant improvement of these motors to meet all of the rugged service conditions encountered today in plants, mills and mines.

Heavy duty, double-taped coils, for example, are impregnated with a wear-resistant polymerizing varnish which assures unsurpassed mechanical protection. For other important construction features, mechanical designs, dimensions and selection data, write for Bulletin C-2001.

Constant and adjustable-speed Type 'T' Heavy Duty D-c. Motors are available from ¾ through 1000 horsepower.

Type 'T' Heavy Duty D-c. Motor Frame with 6-pole field windings

Sales Representatives in Principal Cities

RELIANCE ELECTRIC AND ENGINEERING CO.

"Motor-Drive is More Than Power" • 1063 Ivanhoe Road, Cleveland 10, Ohio

Hough scores again with still another new PAYLOADER. This model HAH, like all other PAYLOADERS, is a complete Hough-designed-and-built tractor and shovel with the same outstanding features and advantages that have established PAYLOADERS as first choice in industry for handling bulk materials.

This fast-travelling, short-turning unit can scoop-up a ton of materials and carry it fast over floors or ground, through narrow aisles and up ramps. Precise hydraulic dump control deposits the loads carefully or abruptly at any height up to 91 inches. The Model HAH will also stockpile and windrow materials . . . will lift, lower, and push. It can be depended on to do hard work on a 24-hour-a-day basis and to handle many bulk material moving jobs, with great savings in time, labor and costs.

It has everything in design, efficiency and stamina for which PAYLOADERS are famous and is sold and serviced by Hough Distributors world-wide.

The Frank G. Hough Company, 754 Sunnyside Avenue, Libertyville, Illinois.

- **Four forward and four faster reverse speeds up to 23 mph.**
- **Separate quick-acting forward-reverse shift.**
- **Full hydraulic control of bucket — lift, dump, close, lower.**
- **Automatic quick tip-back of bucket.**
- **Compact, stable and maneuverable.**
- **Fullest operator visibility.**
- **Large pneumatic tires.**

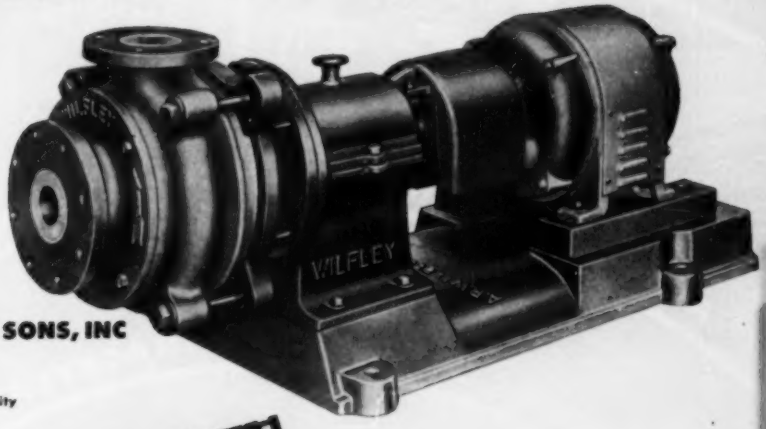
WRITE for information on the Model HAH or other PAYLOADERS from 12 cu. ft. to 1½ cu. yd. capacity. Also ask for your copy of "Industrial Handling" the magazine of PAYLOADER uses.

PAYLOADER®

THE FRANK G. HOUGH CO. · Since 1920

cupric chloride

BUY WILFLEY FOR COST-SAVING PERFORMANCE



A. R. WILFLEY & SONS, INC
Denver, Colo., U.S.A.
New York Office:
1775 Broadway, New York City

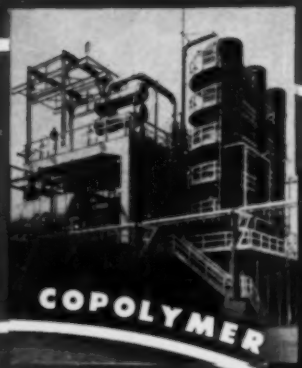
A leading Rocky Mountain refinery uses these two Wilfley plastic lined acid pumps for cupric chloride service in their gasoline sweetening process. Performance is continuous; efficiency is high. Wetted pump parts feature extra long life.

C*orrosives, hot liquids, acids and mild abrasives...* all are handled on a continuous, trouble-free schedule by WILFLEY Acid Pumps. Actual production records of chemical plants all over the world prove the high efficiency, dependability, and substantial savings in operating costs of these famous pumps.

Available in 10- to 2,000-G.P.M. capacities; 15- to 150-ft. heads and higher. Individual engineering on every application. *Write or wire for details.*

WILFLEY *Acid* PUMPS

COMPLETE SYNTHETIC RESINS PLANTS



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P. O. BOX 778
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MANY OF AMERICA'S BEST SYNTHETIC RESIN PLANTS
WERE DESIGNED AND BUILT BY BLAW-KNOX

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U.S.I. CHEMICAL NEWS

June ★ A Monthly Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1951

Sodium Salt of Ethyl Acetoacetate Available In Sample Quantities

The sodium salt of ethyl acetoacetate is now available from U.S.I. in sample quantities. A very reactive compound, the chemical has many potential uses as an intermediate in organic syntheses.

The sodium salt of ethyl acetoacetate reacts with most types of organic halogen compounds to a varying degree. It reacts quite readily with aliphatic halogen compounds, and with aromatic halogen compounds in which the halogen is not on the benzene ring.

The chemical is extremely reactive with the acyl group (COCl), reacting readily with ethyl chloroformate and benzoyl chloride. Other reactions include preparation of ethyl-B-hydroxyethylacetoacetate by reacting with ethylene chlorohydrin, and preparation of aceto-diethyl succinate by reacting with chloroethylacetate.

Properties

Assay
70% by weight as sodium salt
Physical Form
Fluffy powder
Color
Light brown
Bulk Density
40-45 lbs./cu. ft.

New-Type Synthetic Rubber, Made from Milk, Sugars, Tops All Other Rubbers

An improved synthetic rubber, said to be better than other synthetics and natural rubber for many uses has been announced. It is claimed to have outstanding resistance to water, oils, heat, below-zero temperatures and aging. This new rubber is expected to be superior to other rubbers, both natural and synthetic, for such uses as oil seals in automobile transmissions, refrigerant seals, gaskets and linings for fuel tanks.

The improved rubber is made from butyl acrylate and acrylonitrile which can be produced from milk or corn sugars. By varying the proportions of these two compounds, the rubber's property of swelling in oil can be modified, it is claimed, without changing its resistance to heat.

'Inoculate' Timber Against Insects, Decay

A new method of treating timbers for use in coal mines involves injecting certain chemicals into living trees to "inoculate" them against insects and decay. The chemicals used so far in tests include both organic and inorganic compounds in water solutions.

The solutions are reportedly injected into the sap-stream of green trees at the base and carried through the sapwood to the foliage without entering the heartwood or the bark. Treated timbers can be used without removing the bark or waiting for the wood to season. Chemicals tested include zinc chloride, sodium arsenite, ammonium bifluoride, copper sulfate, copper carbonate with ammonium hydroxide and tetrachlorophenol.

U.S.I. to Build New Plant To Produce Allethrin

Allyl Homolog of One of Pyrethrin's Active Principles, Allethrin Will Help Fill Defense Needs for Insecticides

Plans for construction of a plant to produce allethrin, a chemical with some of the unique advantages of natural pyrethrum, were announced recently by W. P. Marsh, Jr., president of U. S. Industrial Chemicals, Inc. The plant, first to be devoted to commercial production of allethrin, will be located on U.S.I.'s property in Baltimore. Construction is to be started immediately and is expected to be completed late in 1952.

In making the announcement, Mr. Marsh stated that production of the chemical would aid materially in filling the needs of the de-

Tests have shown that allethrin has a high degree of effectiveness against house flies, making it a good ingredient for aerosols.

fense effort for adequate supplies of insecticide materials, especially since pyrethrum has been scarce and is expected to continue in relatively short supply for several years. Factors in the pyrethrum shortage include increased demand for non-toxic insecticides and development of new uses for pyrethrum-type (formulations containing pyrethrins and a synergist) insecticides.

U.S.I. orginated the combination of pyrethrins from natural pyrethrum with piperonyl butoxide, a synthetic chemical. The synergistic action of piperonyl butoxide with pyrethrins has not only helped to extend the available supplies of pyrethrum, but has also increased the effectiveness of the older insecticide material. Combination of pyrethrins and piperonyl butoxide are marketed exclusively by U.S.I. – under the trade-name Pyrenone.

Will Supplement Pyrethrum Supplies

Work to date has shown that allethrin has a high degree of effectiveness against some species of insects. On houseflies the synthetic compound is apparently equal in effectiveness to natural pyrethrum, at least under some conditions. In tests against certain other insects allethrin appeared to be less effective than pyrethrum. Careful, thorough entomological investigations are being continued to determine correct allowances of allethrin in formulations and what the behavior of these

MORE

New 'Yardstick' Measures Millionth-of-an-Inch Film

A new kind of "yardstick" which uses different colors to measure millionth-of-an-inch thicknesses of materials in the form of extremely thin films has been developed. The new tool, called a "stepgage", is said to be used like a yardstick, but in place of linear inches are blocks of different colors, each of which represents a different thickness. The blocks of color are reportedly mounted on a length of glass in the shape of a measuring rule.

Color Varies with Thickness

In films a few millionths of an inch thick, the scientist who developed the gage explained, colors vary with changes in thickness, permitting a particular color to indicate a particular thickness. To use the stepgage, the color of a film of unknown thickness is matched to that block of color on the stepgage which is the same or similar. A thickness reading marked underneath that particular block of color on the stepgage indicates the thickness of the unknown film. Color blocks on the stepgage which the researcher demonstrated run from one-millionth-of-an-inch thick to 30 millionths, although gages with wider ranges reportedly can be made.

The stepgage is said to be proving a valuable tool in research work not only for determining extremely fine thicknesses but also for measuring ultra-light weights. Knowing both thickness and density of a material, its weight can be computed. The gage should be particularly useful in measuring materials deposited on a surface by evaporation.

Lignin 'Waste' Now Used As Rubber Reinforcing Agent

Recent research indicates that lignin, previously regarded as just a waste product of the paper industry, is an excellent reinforcing agent for various types of rubber, including natural, nitrile, and neoprene rubber and GR-S. The researchers found that when they added lignin to natural rubber it gave higher tensile strengths than any other pigment, including carbon black, at the same volume. Added to nitrile rubber it also gave higher tensile strengths, according to their report. The scientists indicated that a novel combination of properties can be obtained by co-precipitation with natural, nitrile, neoprene and GR-S. The low specific gravity of lignin also makes possible a lighter-weight product.

ADVERTISEMENT—*This entire page is a paid advertisement* *Prepared Monthly by U. S. Industrial Chemicals, Inc.*

June ★ **U.S.I. CHEMICAL NEWS** ★ 1951

Radioactive Virus Tests Point to Cell Destruction

Recent studies of virus reproduction, employing bacteriophages labeled with radioactive tracers, may hold a clue to the reason polio and other virus diseases spread so rapidly. Test results indicate that in less than one half hour after the virus particle invades a living cell, 200 to 300 emerge simultaneously, destroying the cell.

The viruses used in the test are of a type that attack common sewage bacteria and have all the characteristics of viruses that cause diseases in humans and animals. Under the electron microscope these bacteriophages appear as particles one-hundred thousandth of an inch long, with a head, body, and tail — something like a tadpole.

By labeling various kinds of molecules within the bacteria, scientists hope to determine how viruses reproduce and how they kill cells. According to one theory they use tissue and cell compounds for food. Another theory states that the viruses use the chemical processes of the cell to produce viruses instead of normal cell constituents from the food in the surrounding medium.

CONTINUED *Allethrin Plant*

formulations against specific insects will be. Although allethrin cannot be regarded as a *substitute* for natural pyrethrum for many uses, its availability will *supplement* the present limited supplies of natural pyrethrum and facilitate the current rapid expansion in the use of pyrethrum-type insecticides.

New Way To Protect Stored Grains

One of the most exciting of the new uses for Pyrenone-type insecticides is in protecting stored grains. Pyrenone® Wheat Protectant and Pyrenone® Grain Protectant, containing pyrethrins and piperonyl butoxide, are now being mixed directly with stored grains at harvest time and give season-long protection against insects. These new Protectants, non-toxic to humans and warm-blooded animals, promise to save literally hundreds of millions of dollars' worth of stored grain now destroyed by weevils and other insects each year.

*Reg. U. S. Pat. Off.

Produce Paper From Glass Fibers, Mica

Production of satisfactory paper from glass fibers and from mica has been announced. In the past, except for asbestos, inorganic fibers have not proven suitable for making paper. If it can be produced commercially, glass paper should be useful in making electrical insulation. Its resistance to combustion (up to 800°C.) will probably make it valuable as a wrapping for air-cooled transformers.

The new paper produced from mica is described as a superior dielectric for capacitors. Kraft paper condensers in use currently do not operate satisfactorily above 85°C., it is reported. The new mica paper is claimed to be stronger, to withstand heat, and to have a greater capacitance.

New Data on German Drug Research Available

Descriptions of German developments in the pharmaceutical field are reported available now in the form of English translations of patent applications filed from October 1948 to May 1950. Besides these patent applications, the new bulletin is said to have a section listing over a dozen reports that give detailed descriptions of manufacturing processes for synthetic hormones. Instructions for making desoxycorticosterone acetate, estradiol, testosterone, and progesterone are included. Reports also describe various German analytical methods.

New Book of Abstracts On Polyvinylpyrrolidone

A book of abstracts of all the published literature on polyvinylpyrrolidone, the synthetic blood plasma substitute, has been released. The 188-page volume represents the work of 284 authors and includes literature on patents and patent applications. It contains 227 abstracts covering investigations of the applications of polyvinylpyrrolidone in many phases of medicine. Included are papers on its use with other drugs, such as penicillin and insulin. The abstracts give information on studies, some completed as recently as May 1950, in Germany, England, France, Italy, and Switzerland.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

New-type inks for printing on plastic film reportedly based on vinylite resins for maximum printing quality, color density, uniformity, and smoothness, give permanent adhesion permitting printed film to be wiped clean with a damp cloth without damage to design. **(No. 689)**

An unbreakable polyethylene wash bottle is said to enable lab workers to dispense liquids in a controlled stream by squeezing bottle. Bottle is fitted with polyethylene spout. **(No. 690)**

An inexpensive vacuum gauge in multi-station form for coaters, dehydrators, vacuum furnaces, etc., is described as simple to use. All stations read on a single meter and range is from a few microns to 1 mm. of Hg, it is claimed. **(No. 691)**

A new multi-purpose glue for use as a wood adhesive, abrasive binder, etc., cures rapidly in continuous lumber core binding operations and is also satisfactory for cold press-assembly gluing where heavy glue lines are unavoidable, the makers state. **(No. 692)**

To provide a lasting smooth coating for polystyrene products, a new lacquer for application in standard spray equipment is said to be available in several colors, to air dry in about 15 minutes, to have good adhesion and durability, and to give an all-over uniform finish. **(No. 693)**

A new synthetic dark organic wax, claimed to form an effective moisture barrier and to have good electrical properties, is recommended for impregnating electrical components. Other potential uses are for waterproofing and laminating paper, textiles, wood, etc. **(No. 694)**

An air-drying plastic coating for protection of chemical processing equipment against attack from corrosive chemicals, weathering, and rust, reportedly has high film flexibility, good adhesion and impact resistance. Will not chip or crack, it is claimed; can be used on steel, aluminum, concrete, hardwood, composition board. **(No. 695)**

Laminated fabrics with a three dimensional effect are reported available for use in fashion goods, draperies, furniture, etc. Color prints and patterns are said to be sealed in between twin layers of vinylite plastic which can be cleaned with a damp sponge. The patterns are embossed with three-dimensional taffeta-weave textures, according to the maker. **(No. 696)**

New paints that resist temperatures up to 1,800°F. can be applied by conventional methods to wood or metal and will resist moisture, acids, and alkalies, it is claimed. **(No. 697)**

An improved tall oil said to give fast, hard dry and high chemical resistance, is recommended as a checking oil in varnishes and modifier in flat, semigloss, and full gloss systems, barn paints, and as a wood preservative. **(No. 698)**

PRODUCTS OF U. S. I.

ALCOHOLS
Amyl Alcohol (Isoamyl Alcohol)
Butanol (Normal-Butyl Alcohol)
Fusel Oil—Refined
Propanol (Normal-Propyl Alcohol)
Ethanol (Ethyl Alcohol)
Specially Denatured—all regular and anhydrous formulas
Completely Denatured—all regular and anhydrous formulas
Pure—190 proof U.S.P., Absolute—200 Proof
Solox*—proprietary solvent—regular and anhydrous
ANTI-FREEZE
Super Pyro* Anti-Freeze
U.S.I. Permanent Anti-Freeze
ANSOLS
Ansol* M
Ansol* PR
ACETIC ESTERS
Amyl Acetate—Commercial and High Test
Butyl Acetate
Ethyl Acetate—all grades
Normal-Propyl Acetate
OXALIC ESTERS
Dibutyl Oxalate
Diethyl Oxalate
PHTHALIC ESTERS
Diamyl Phthalate
Dibutyl Phthalate
Diethyl Phthalate
OTHER ESTERS
Diatol*
Diethyl Carbonate
Ethyl Chloroformate
INTERMEDIATES
Acetoacetanilide
Acetoacet-ortho-chloroanilide
Acetoacet-ortho-toluidide
Acetoacet-para-chloroanilide
Ethyl Acetoacetate
Ethyl Benzoylacetate
Ethyl Sodium Oxalacetate
ETHERS
Ethyl Ether, U.S.P.
Ethyl Ether, Absolute—A.C.S.
ACETONE — A.C.S.
FEED PRODUCTS
Curbay B-G*
DL-Methionine
Riboflavin Concentrates
Special Liquid Curbay*
U.S.I. Vitamin B12 and Antibiotic Feed Supplements
Vacatone* 40
RESINS (Synthetic and Natural)
Arochem*—modified types
Arofene*—pure phenolics
Arofint—for special flat finishes
Aroplas*—alkyds and allied materials
Congo Gums—raw, fused & esterified
Ester Gums—all types
Natural Resins—all standard grades
INSECTICIDE MATERIALS
CPR Concentrates: Liquid & Dust
Piperonyl Butoxide
Piperonyl Cyclonene
Pyrenone* Concentrates: Liquid & Dust
Pyrethrum Products: Liquid & Dust
Rotenone Products: Liquid & Dust
INSECTIFUGE MATERIALS
Indalone*
Triple-Mix Repellents
OTHER PRODUCTS
Collodions
Ethylene
Nitrocellulose Solutions
PB*—Liquid Insulation
Urethan, U.S.P.
Special Chemicals and Solvents

*Reg. U.S. Pat. Off.

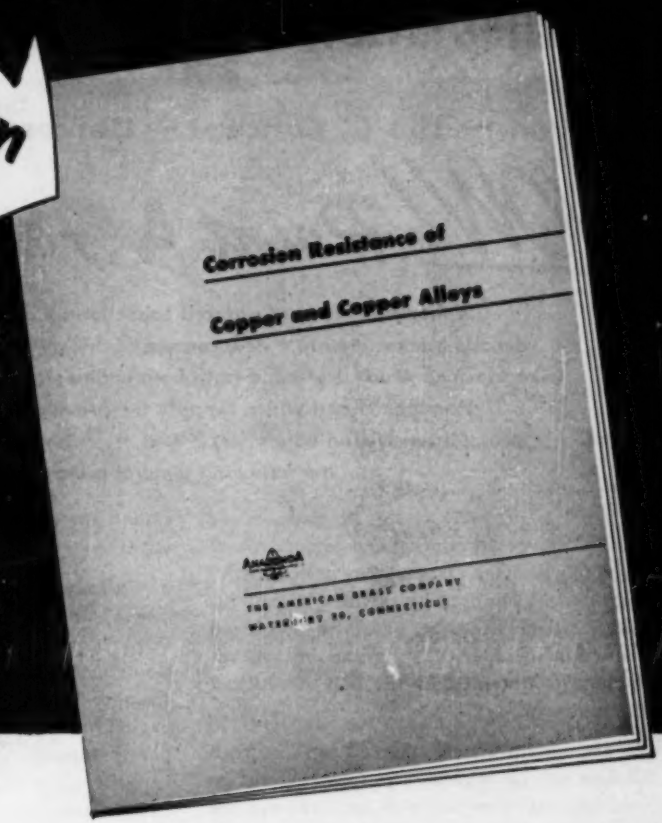
U.S.I INDUSTRIAL CHEMICALS, INC.

60 EAST 42ND ST., NEW YORK 17, N.Y. U.S.I. BRANCHES IN ALL PRINCIPAL CITIES

New Corrosion Data!

YOU WILL WANT THIS IMPORTANT BOOKLET

containing a new collection of data on corrosion resistance of copper and copper alloys.



For operators and designers of:

Process Equipment
Heat Exchangers
Condensers
Evaporators
Chemical Equipment
Waterworks and Sewage Plants

This new booklet presents in concise, usable form important technical discussions and data on the corrosion resistance of copper and copper alloys. Here are the subjects included:

- **Theory of Corrosion and Types of Corrosive Attack**
- **General Discussion of Corrosion Resistance of Copper Alloys**
- **Corrosion Rating Charts**
- **Typical Industrial Uses of Copper Alloys**
- **Composition, Mechanical and Physical Properties of Copper Alloys**

A1130

SEND FOR YOUR FREE COPY TODAY!

The American Brass Co., Waterbury 20, Conn. (In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.)

Please send me my copy of your new booklet, "Corrosion Resistance of Copper and Copper Alloys."

NAME.....

COMPANY.....

STREET.....

CITY.....ZONE.....STATE.....

where corrosion resistance counts — consider

ANACONDA®

COPPER AND COPPER ALLOYS

Another Mason-Neilan Basic

In 1944 — The C_v Concept — Universally Used Today

NOW! Point 4 Factor Trim

A thorough study of reduced capacity trim over the past decade has resulted in a new concept of the entire subject, leading to conclusions which are sound from both engineering and manufacturing standpoints and which simplify the problem for the user. Mason-Neilan now offers *Point 4 Factor Trim* based on the following general principles:

1. Since a properly designed wide range control valve will control satisfactorily near its stroke limits, a vast majority of flow problems can be handled by valves with full capacity trim. Therefore, unless the required reduction in capacity is appreciable, no advantage is obtained by the use of reduced capacity trim.

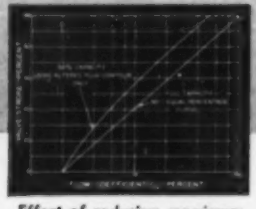
2. The only practical reduced capacity trim design is one which *extends the minimum* controllable flow as well as *reducing the maximum*. A simple analysis shows that to extend the minimum controllable flow it is *necessary to reduce the seat ring diameter.*

3. *Only one reduction* is practical for a given size top-and-bottom guided, double or single seated control valve. The optimum reduction consistent with retention of mechanical strength is approximately 60% of full capacity; hence the capacity of a valve with reduced capacity trim should be .4 of full capacity. The logical description of this trim is therefore —

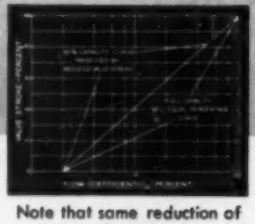
Point 4 Factor Trim

There are a number of valid reasons for specifying reduced capacity trim in control valves for industrial processes. Masoneilan *Point 4 Factor Trim* provides standardization, plus convenience in selection and procurement in handling these unusual applications.

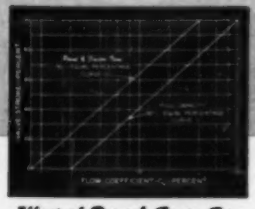
Complete details are available on request.



Effect of reducing *maximum* flow by altering plug contours only.



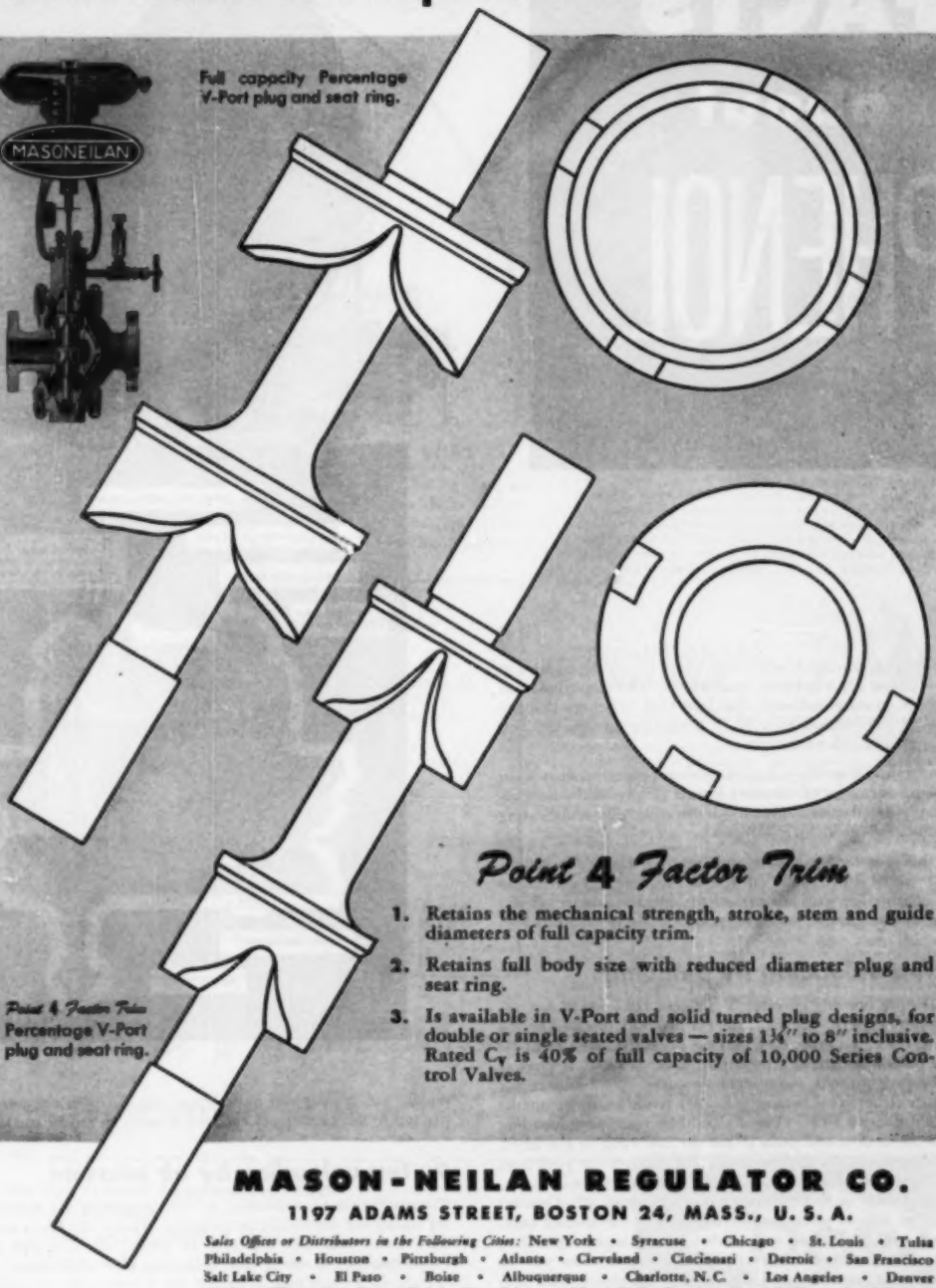
Note that same reduction of *maximum* flow can be obtained by reducing stroke by means of positioner adjustment or altered spring characteristic.



Effect of *Point 4 Factor Trim* obtained by using reduced plug and seat ring diameters.

Contribution to Simplified Valve Selection

Full capacity Percentage V-Port plug and seat ring.



Point 4 Factor Trim

Percentage V-Port plug and seat ring.

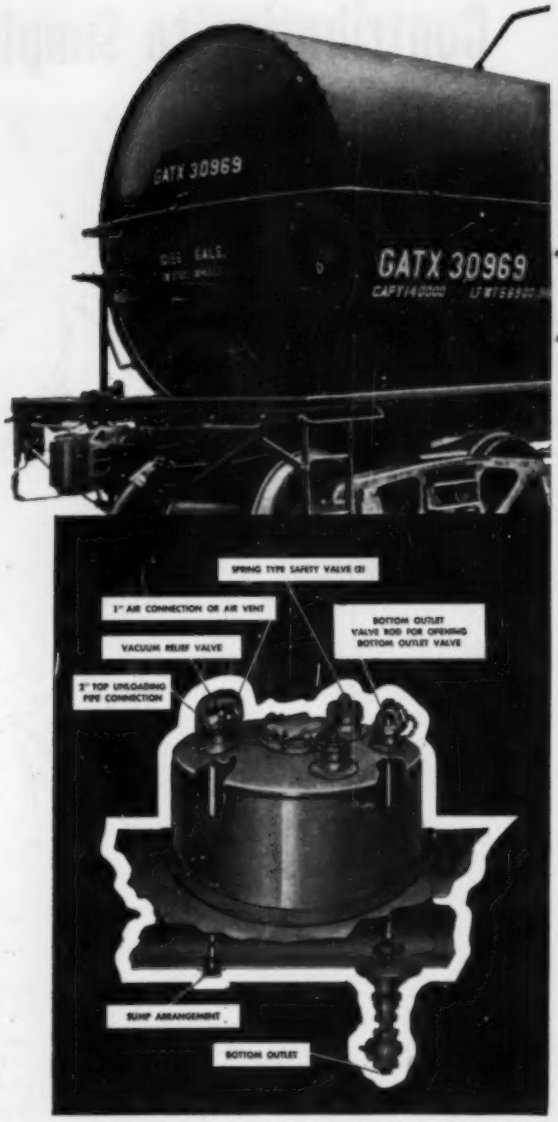
1. Retains the mechanical strength, stroke, stem and guide diameters of full capacity trim.
2. Retains full body size with reduced diameter plug and seat ring.
3. Is available in V-Port and solid turned plug designs, for double or single seated valves — sizes 1¼" to 8" inclusive. Rated C_v is 40% of full capacity of 10,000 Series Control Valves.

MASON-NEILAN REGULATOR CO.

1197 ADAMS STREET, BOSTON 24, MASS., U. S. A.

Sales Offices or Distributors in the Following Cities: New York • Syracuse • Chicago • St. Louis • Tulsa Philadelphia • Houston • Pittsburgh • Atlanta • Cleveland • Cincinnati • Detroit • San Francisco Salt Lake City • El Paso • Boise • Albuquerque • Charlotte, N. C. • Los Angeles • Denver Appleton, Wisconsin • Corpus Christi • New Orleans Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

FACTS about PHENOL


GATX 30969
GATX 30969
SPRING TYPE SAFETY VALVE (2)
1" AIR CONNECTION OR AIR VENT
VACUUM RELIEF VALVE
2" TOP UNLOADING PIPE CONNECTION
BOTTOM OUTLET VALVE ROD FOR OPENING BOTTOM OUTLET VALVE
SUMP ARRANGEMENT
BOTTOM OUTLET

IN times of shortages, additional effort should be expended to use materials efficiently and wisely. The importance of phenol in so many industries has lead Dow to believe that the following information may be of assistance in helping you realize greater value from phenol.

Phenol is used in many manufacturing processes. It is used in the manufacture of: bonding agents for plywood—thermosetting type plastics—toluene—lubricating oils—lubricating oil additives—medicinals—dyes—perfumes—explosives.

Dow believes that complete and comprehensive information about phenol is extremely valuable at this time and is ready to help you further with advice and technical assistance. If you desire additional information, write to Dow, using coupon below.

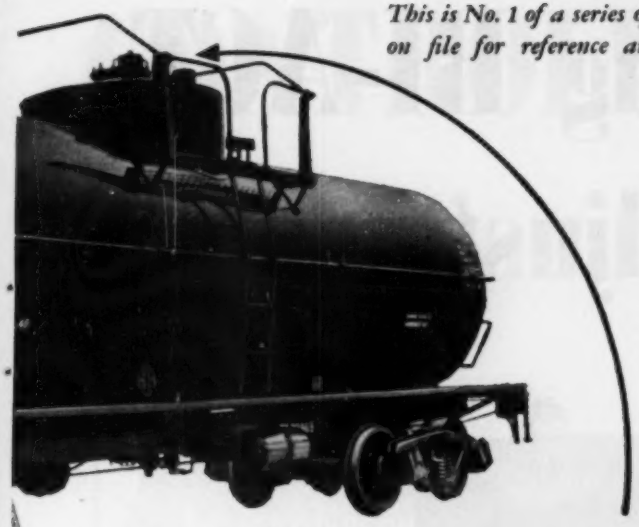
1. *Top unloading by pumping*

(1) Remove housing covering 1" air vent valve and 2" top unloading pipe valve. (2) Vent the car carefully by opening the 1" vent valve. To make sure that car is vented, open manhole cover bolts one turn at a time until cover is loose. If there is no pressure present, open manhole cover. (3) Connect low pressure steam to car heating coils. (4) Avoid heating contents of the car above 70°C. Phenol should be ready for unloading when the bottom and ends of the car are warm to the hand, providing the car is not insulated. (5) Remove the plug from the 2" top unloading valve and make sure that there is no unmelted phenol or foreign matter obstructing it. (6) Connect discharge side of pump to line running to the storage tank. Storage tank should be well vented. (7) Connect unloading line to the suction side of pump. The manhole cover may be left open for inspection. (8) Disconnect the piping after phenol has been pumped from car and wash off any phenol. Close all dome openings and blow out steam coils to prevent any residual condensate freezing and bursting the coils. Do not replace steam inlet and outlet caps. (9) Turn "Dangerous" placard to indicate empty car now is ready to return to Dow.

2. *Top unloading by air pressure*

Prepare the car for unloading by following items (1) through (5) under top unloading by pumping. Then: (6) Close manhole cover and bolt securely in place. (7) Connect the unloading line to the 2" top unloading pipe connection. Be certain the storage tank is vented. (8) Connect the air supply line (air pressure not to exceed 20 p.s.i.) to the 1" vent valve. (9) Observe the same procedure after the car is empty of phenol as before.

This is No. 1 of a series of Dow advertisements you may wish to keep on file for reference and information. Write Dow for reprints.



UNLOADING PHENOL TANK CARS

Be sure that tank cars stand on a level section of track in order to assure complete unloading of the car. Either of the following two methods may be used, but the first, *top unloading by pumping* is the safer, and the one recommended.

Physical Properties of Phenol

Phenol is a white crystalline chemical compound with an easily recognized aromatic odor.

Molecular Weight	94.11
Congealing or Freezing Point	40.9°C.
Boiling Point at 760 mm. Hg.	182.0°C.
Density	
Solid—at 25°C.	1.071 g./ml.
Liquid—at 50°C.	1.049 g./ml.
Critical Points	
Critical Temperature	419°C.
Critical Pressure	60.5 Atmospheres
Specific Heat	
Solid—at 4.0°C.	0.306
—at 22.7°C.	0.338
Liquid—70-74°C.	0.548
Viscosity	
Liquid at 45°C.	4.0 centipoises
Heat of Fusion	2690 cal./g. ml. 28.6 cal./g. 51.5 B.t.u./lb.
Heat of Vaporization at 182°C.	103.4 cal./g. 186.1 B.t.u./lb.
Heat of Combustion	732 K. cal./g. ml.
Flash Point	79.0°C.
Solubility	
Water in Phenol at 25°C.	71.28 g./100 g. solution
Phenol in Water at 25°C.	8.66 g./100 g. solution

Phenol is soluble in all proportions at room temperature in alcohol, benzene, monochlorobenzene and ether.

STORAGE

In solid state, phenol may be stored in the original container for considerable time without discoloration. Molten phenol, however, discolors when in contact with iron or copper-bearing metals. The higher the temperature, the more rapid the discoloration.

Storage tanks may be either welded or riveted construction. Tanks are usually equipped with steam coils for melting the phenol (temperatures should not exceed 70°C.) for transfer.

TRANSFER

When molten, phenol can be transferred like any other liquid, by gravity, pumping or blowing. Centrifugal and turbine type pumps are generally used and are satisfactory. A pump manufacturer can recommend suitable equipment when your requirements are known. Long fiber asbestos, lubricated with graphite, gives reasonable service when used as a pump packing. Pipe lines for handling phenol should be heated to maintain it in a liquid state. Steam-traced lines are usually used. Outside pipe lines in cold climates should be traced with ⅜" to ½" steam lines dependent on the length of run and size of the line to be heated, with the tracer along the bottom of the pipe line, and both covered together with standard pipe covering. Short runs inside heated buildings should be traced on the under side of the pipe line, but need not be covered to keep the phenol above its melting point if more than 100 p.s.i. steam is used in the tracer line.

PRECAUTIONARY MEASURES

Phenol produces painful and dangerous burns of the skin in a very short time and death may result from external contact even on an area as small as the hand and forearm. It is classified by the Interstate Commerce Commission as a Class B poison and all containers bear the prescribed "DANGEROUS" placard or "POISON" label. Fumes are irritating to eyes and nose.

Persons engaged in handling phenol should always wear goggles or face shields and rubber gloves. Additional protection such as rubber boots, aprons and hoods may be advisable.

There should be adequate washing facilities immediately available. These facilities should include a shower bath or a water hose which gives a large stream of water under low pressure. For washing eyes, use a flow of water under low pressure.

In case phenol is spilled, it should be thoroughly washed away with water. Torches or heat sources other than low-pressure steam should never be used on phenol containers. No workman should ever be permitted to enter an empty tank or car which has been used for phenol until it has been thoroughly washed out, followed by a thorough steaming for approximately 12 hours.

In case of accidental contact: 1. Begin a thorough washing with large volumes of water. 2. Remove all contaminated clothing. 3. Call a physician.

If you have a Phenol problem

write DOW for information and technical assistance

THE DOW CHEMICAL COMPANY
Midland, Michigan

The Dow Chemical Company, Dept. OC-5,
Midland, Michigan

☐ **Please send me literature about phenol.**

☐ **Please send _____ reprints of this advertisement.**

Name _____ Title _____

Company _____

Address _____

City _____ State _____

DOW
CHEMICALS
INDISPENSABLE TO INDUSTRY AND AGRICULTURE

Announcing BI-ACT* Single-Adjustment of

SINGLE KNOB
STABILITY
ADJUSTMENT

CONTROLLER with Proportional & Reset

An inexpensive force-balance controller with proportional and automatic reset adjusted by a single knob. Particularly suited for flow applications. A logical addition to the TRANSET* Control System.

BI-ACT is TRI-ACT's* little brother. The inexpensive BI-ACT Controller has *two* control responses, proportional and automatic reset, with both adjusted by *one* knob. It is the ideal controller for dependable, accurate performance on locally mounted flow and similar control applications where it is felt that the quality of control obtainable with the three responses of the TRI-ACT Controller is not essential.

TAYLOR'S NEW BI-ACT CONTROLLER GIVES YOU:

1. Single-Adjustment of Proportional and Reset.

2. Simple stability "tune in".

3. Low cost.

Taylor's TRANSET Control System, with its three component units, is the new concept in pneumatic control that everybody is talking about. The three units, TRANSAIRE*, TRI-ACT and TRANSET, are designed to work together as a team to take advantage of each other's superior performance on all applications. Now Taylor has added the inexpensive BI-ACT Controller to extend the scope of the 3-part Transet Control System.

Write for Bulletin 98070

Taylor Instrument Companies,
Rochester, N. Y., or Toronto, Canada

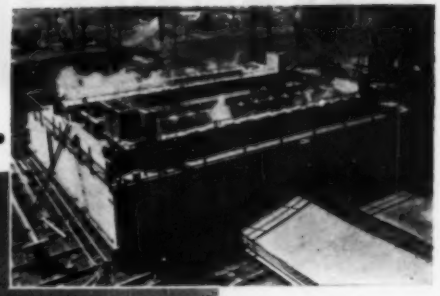
Instruments for indicating, recording and controlling temperature, pressure, humidity, flow, liquid level, load, speed, and density.

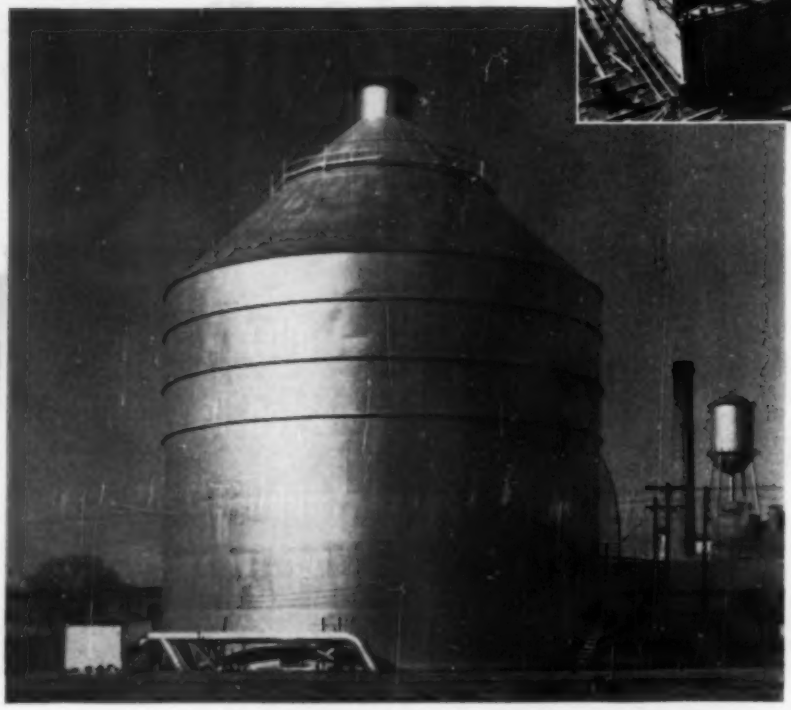
*Trade-Mark

Taylor's Centennial ACCURACY FIRST SINCE 1851

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

LONGER TANK LIFE *starts here...*





STEEL TREATED BY PHOSCOTE PROCESS MEANS NEW ECONOMIES

STEEL PLATES for the Farmers Cotton Oil Company plant's cottonseed and soybean tank at Wilson, North Carolina, were assured a longer, more useful life by the Phoscote Process.

Here is an efficient, economical method of removing mill scale from steel and providing the cleaned surfaces with a coating that greatly improves the bond between steel and paint. The steel is protected for years to come.

The Phoscote Process consists of dipping steel plates or shapes successively into three vats. The first contains a hot dilute sulphuric acid solution which descales the steel—the second is filled with rinse water—and the third contains a hot dilute phosphoric acid solution. Then, while the steel is still warm, a coat of paint is applied to protect the cleaned surface.

When ordering tanks or steel plate work from Chicago Bridge & Iron—take advantage of the Phoscote Process. The coming years will prove your good judgment.

CHICAGO BRIDGE & IRON COMPANY

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Los Angeles 17...1505 General Petroleum Bldg.
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2 BLENDERS DO THE WORK OF 4 ... BETTER AND FASTER

Auburn Button Works, Auburn, N. Y. manufactures component plastic parts for the automotive, refrigeration and business machine industries. Uniform blending of plastics and pigments is an important part of the operation.

To check p-k claims for absolute uniformity in blending, an 8-qt. transparent p-k Laboratory Blender was installed.

Results were so satisfactory that a 2-cu. ft. and a 5-cu. ft. p-k blender were purchased to replace equipment previously used. Soon a second 5-cu. ft. p-k blender will be added. Auburn has found that the two blenders now in service require only 5 to 15 minutes blending time for accurate dispersion, whereas the old blenders required two hours or more for far less satisfactory results. Loading and unloading time has been reduced, and the smooth polished interior surface has reduced cleaning time to a matter of minutes. Either air hose or a dry cloth may be used, regardless of dyes or the materials blended.

p-k Twin Shell Blenders mix dry materials faster and more thoroughly than any other blender. Capacities range from 1 to 250 cubic; speeds from 6 to 29 rpm.

p-k will run experimental mixes of your material without cost or obligation. It will be your introduction to a new, accepted and proved method of dry blending.

p-k blenders: 8-qt. laboratory blender used for sample blends which exactly predict the production run.

Write for catalogs 401 and 402, for complete information.

1012

p-k *70 years of heat transfer experience assures you of superior design and construction*

p-k Mixers
p-k Coolers
p-k Kettles
p-k Agitators
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p-k Reboilers
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p-k Condensers
p-k Evaporators
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p-k Soap Crutchers
p-k Ribbon Blenders
p-k Fuel Oil Heaters
p-k Vapor Condensers
p-k Lube Oil Coolers
p-k Lube Oil Heaters
p-k Reaction Vessels
p-k Instantaneous Heaters
p-k Quenching Oil Coolers
p-k Storage Heaters
p-k Refrigerant Condensers
p-k Twin Shell Blenders*
* Patented

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For your worst enemies

a CONCENTRATION CAMP!

The NULLAPONS*

nullify { SCUM, WASTE, RANCIDITY, CLOUDINESS, DISCOLORATION } by sequestration

Magnesium, calcium (lime), iron, copper, zinc, nickel, chromium and lead . . . these are the more common, *interfering metals*—interfering with processes in which water is involved, impairing the quality of the products thus processed.

Through *sequestration*—with the help of an Antara Nullapon—the action of these metal ions can now be nullified. To all practical purposes, they are locked up in an inert complex.

The applications thus far established include: softeners for hard water; clarifiers for liquid soaps and shampoos; antioxidants for fats, oils, soaps and softeners; foam builders for soaps; sequestrants for polyvalent metal ions; plasticizers for (vulcanized) rubbers; solubilizers for dyes and pigments; dyeing assistants for metal-sensitive dyes, hard-water-sensitive vat dyes and naphthol dyeings; removal of lime soap from textiles; removal of metals and/or metal stains from fabrics and leather.

For Technical Bulletin—and for information regarding our new test kits for determining water hardness—we invite your inquiry, addressed to Department 80.

*"NULLAPON"—Reg. U. S. Pat. Off.

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DIVISION OF

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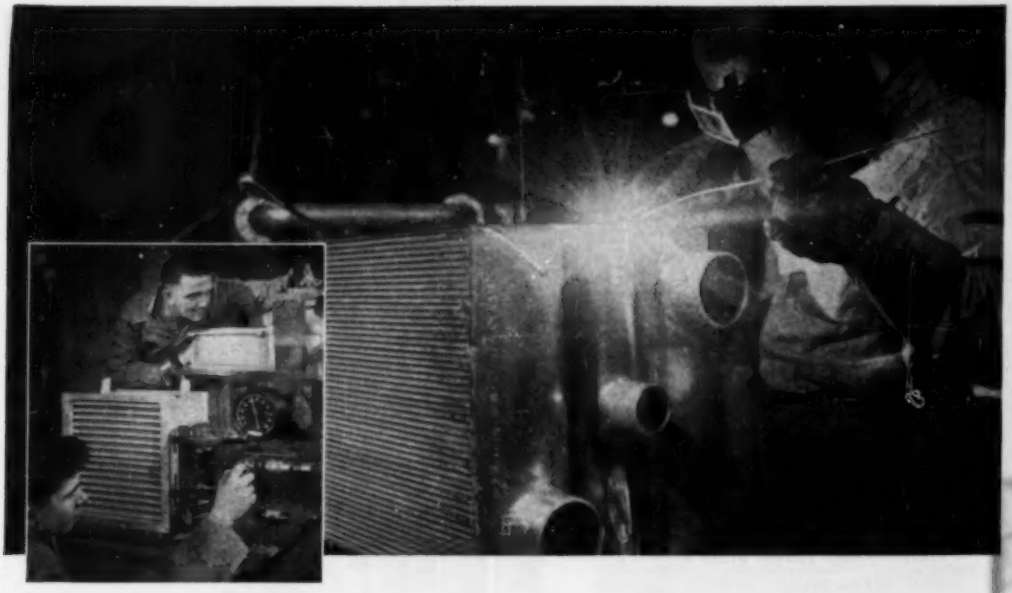

TRANE Announces a New Kind of

LIGHTWEIGHT HEAT TRANSFER SURFACE

Here are the simple facts about Trane *Brazed* Aluminum Surface—a new type of heat exchanger now available for the chemical and process industries:

1. Much lighter than conventional fin-and-tube heat transfer equipment.
2. So strong it has been successfully tested at pressures up to 1000 pounds per square inch. Has withstood 2 million reversals at 100 pounds pressure.
3. Packs up to 450 square feet of total surface in a cubic foot of volume—up to nine times the surface of a comparable volume of ¾" tube shell-and-tube heat exchanger.
4. Operates successfully in temperature ranges from 500°F. to −300°F.
5. One-third to one-half the price of the lowest cost tubular exchanger.

This new heat transfer surface is fabricated entirely of aluminum. Layers of corrugated aluminum sheet—separated by thin plates—are brazed in an exclusive flux bath process. Joints are as strong as the aluminum itself. Brazing is even—bonding uniform. The heat exchanger can be built either for counterflow or crossflow circulation. Headering can be designed to fit the job.

Trane *Brazed* Aluminum Surface can be used for gas to gas, gas to liquid, or liquid to liquid heat transfer. Complete flexibility creates almost unlimited possibilities for its use.

Trane *Brazed* Aluminum Surface will meet practically any specification of heat transfer, pressure drop, volume, number and direction of passes and velocity of fluids.

Trane *Brazed* Aluminum Surface has been completely tested in numerous applications. During the last war, hundreds of aircraft engines were cooled with Trane Aluminum Radiators—one of the earlier forms of the new brazed aluminum surface.

Certain limitations exist on this surface. It is available only in aluminum at present. Small quantities are not economical.

This new development is but a part of the extensive Trane line of heat transfer equipment. Also included is shell-and-fin-tube and fin-tube surface in a wide variety of combinations, tube sizes and materials. If you have a knotty heat transfer problem you may find the answer in the Trane line. Contact the Trane Sales Office nearest you or write direct.

THE TRANE COMPANY, LA CROSSE, WISCONSIN • **Eastern Mfg. Division, Scranton, Penna.**
Trane Company of Canada, Ltd., Toronto • **Offices in 80 U. S. and 14 Canadian Cities**

TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

From Abundant Corn . . .

A More Stable Supply of Polyols!

CORN is our major grain crop—and corn sugar is the major source of Atlas sorbitol. That is why sorbitol is the polyol (polyhydric alcohol) least subject to fluctuations in price and availability.

Sorbitol belongs to the same chemical family as glycerin and the glycols. But it has unique properties that make it superior to all other moisture-conditioners for many purposes. Sorbitol is non-volatile—"stays put" to give *permanent* conditioning. And it gains or loses moisture at a slower rate when exposed to humidity extremes.

Now, Atlas is *doubling* its facilities for producing sorbitol from plentiful agricultural products—a job planned for completion late in 1951. So, *now* is the time for producers of tobacco products, resins, cellulose films, explosives—any product that needs conditioning—to plan to make the most of the advantages of sorbitol. Our research and technical service will be glad to work with you.

Write for the latest information on sorbitol and methods of application in your own industry.

ATLAS CHEMMUNIQUÉ

Stretching Alcohol in Solubilizing Essential Oils

TWEEN® emulsifiers are used alone or as co-solubilizers with alcohol to make sparkling clear dispersions of vitamin oils, flavor oils and perfume oils. (One new use is in making a spray for uniform application of vitamins to animal feeds.) The TWEEN products help overcome objections to volatility of solvent, make a product which keeps its uniformity longer, and act as fixatives.

New Detergent for Dry Cleaning

Atlas G-2684, a 100% active blend of non-ionic detergents and emulsifiers, can be easily and economically compounded into several highly effective types of dry cleaning "soaps." It can be used in both petroleum and chlorinated solvent systems, with or without water. Laboratory whiteness retention tests show it cleans wool as much as 15% cleaner than ordinary potassium oleate and oleic acid type soaps. It has high water-holding and soil-emulsifying power, is efficient in hard water.

RENEX® non-ionic detergent, the active detergent component of many favorite washing and cleaning compounds, is now available in powdered form for greater convenience in compounding. Known as RENEX 25, it has the usual RENEX advantages in high detergent efficiency regardless of water hardness or coldness. Especially effective in compounds for automatic machines, and in stepping up cleaning efficiency of soap in hard water.

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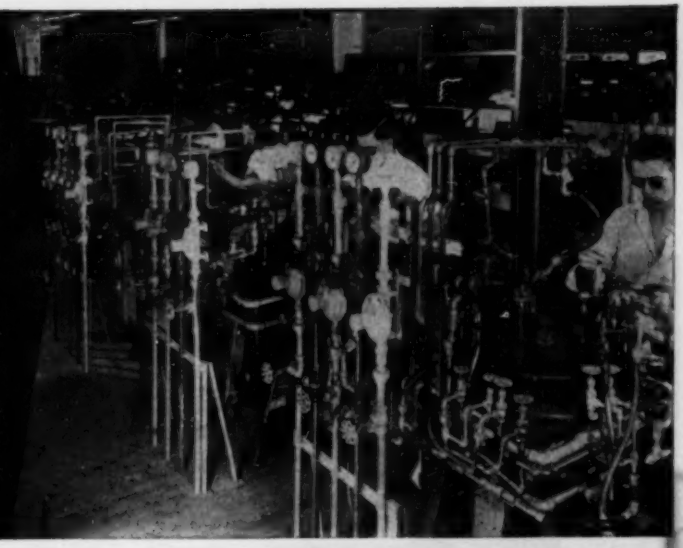


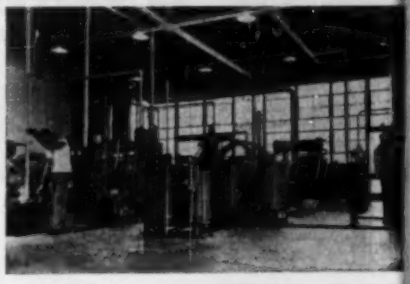
All dried DRY by Lectrodryers at Western Electric Company

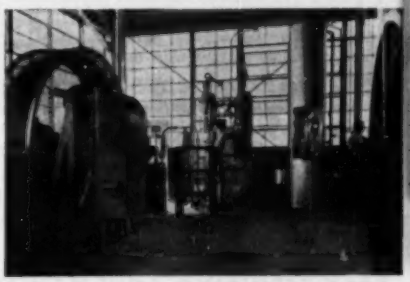
A separate building, isolated for greater safety, houses the gas generators, compressors, driers and auxiliary equipment at Western Electric Company's ultramodern plant in Allentown, Pa. Low and high-pressure air, oxygen, nitrogen and hydrogen all play some part in production here.

Lectrodryers DRY all these gases, working to a dewpoint of −60° F. Thus there's no impairment of processes and products by unwanted moisture. Lectrodryers are also located at many points throughout the Western Electric plant on furnaces and other equipment where DRYing is required.

Thousands of Lectrodryers are at work around the world DRYing air, gases and organic liquids to low dewpoints—speeding production, helping maintain high quality, and making operations independent of weather conditions. When you need DRYing help, Lectrodryer engineers call on this wealth of experience to guide you in the choice of equipment and methods.

For such help, write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh 30, Pennsylvania.





Lectrodryers in Western Electric's Gas Building

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sydney.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

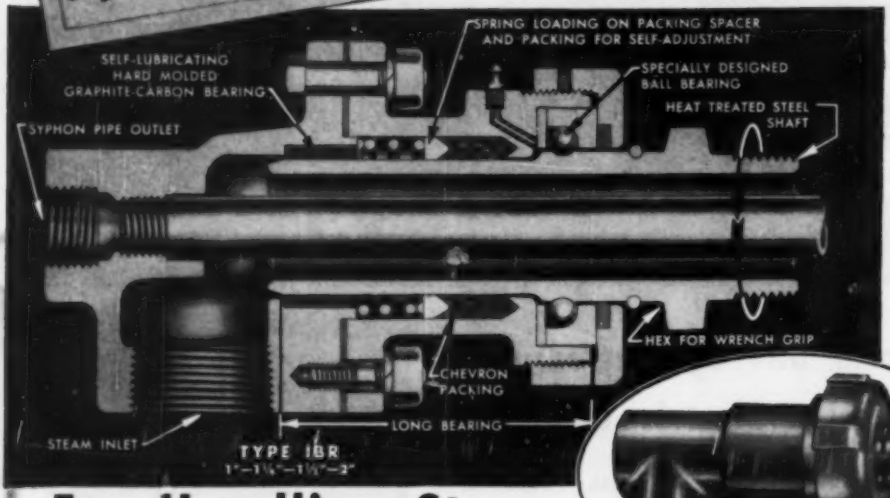
REGISTERED TRADEMARK U.S. PAT. OFF.

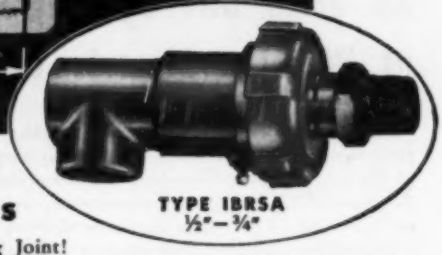
Announcing

The Improved

BARCO

REVOLVING JOINT





TYPE IBRSA
½"–¾"

For Handling Steam
Water • Air • Oil • Gas

HERE is the new *improved* Type IBR Barco Revolving Joint! Precision-built and field-tested, it has met with enthusiastic approval by machinery designers and operating engineers, alike. Here are some of the reasons why:

LOW TORQUE CUTS POWER COSTS! Wide spacing between bearings holds bearing loads to a low limit and maintains close alignment. Specially designed ball bearing carries both radial and end thrust. Inherent low torque is little affected by pressure, speed, or temperature. Up to 50% power savings.

COMPACT, SIMPLE, LEAKPROOF! Self-adjusting, self-sealing chevron type packing carried under light spring pressure provides a long life seal on specially hardened rotating sleeve, permits remarkably compact construction.

EASY SERVICING, LOW MAINTENANCE! Light running action minimizes wear, permits free-floating installation. No adjusting necessary. Internal parts are readily accessible—usually without removing joint from roll.

For the complete story, send today for new Bulletin No. 300 "BARCO REVOLVING JOINTS." Barco Engineers are at your service; ask for recommendations. BARCO MANUFACTURING CO., 1816 G Winnemac Avenue, Chicago 40, Illinois. In Canada: The Holden Co., Ltd.

Syphon Style—TYPE IBR. Built for 450°F., steam service to 150 psi, and up to 500 RPM. Hydraulic service to 200 psi, 750 RPM. Higher pressure and speeds under certain conditions.

Single Flow Style—TYPE IBRSA. Similar to Type IBR. Sizes 1" and larger have 2-piece flange connected body.

Other BARCO Revolving Joints

TYPE R and RS — Double row ball bearing construction. Maximum pressure 250 psi (steam) or 500 psi (hydraulic). Syphon and single flow styles.

TYPE V— Small size, light duty, for speeds up to 2500 RPM.

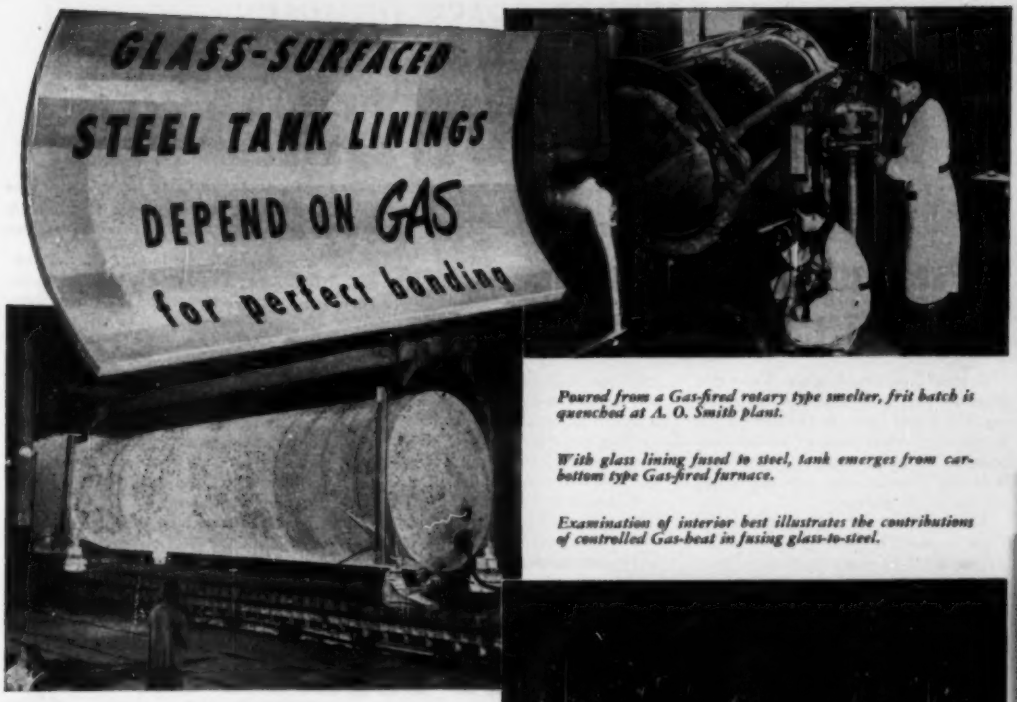
BARCO

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE, SWIVEL, SWING AND REVOLVING JOINTS

Worldwide Sales and Service

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

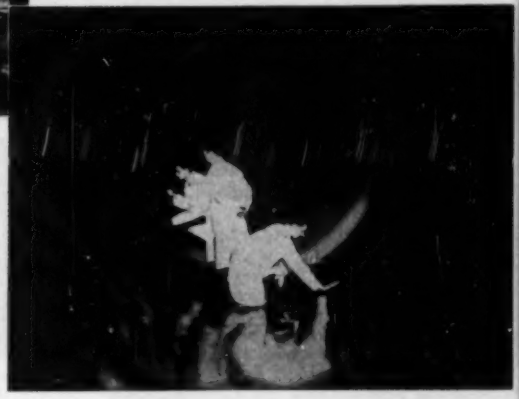
GLASS-SURFACED STEEL TANK LININGS DEPEND ON GAS for perfect bonding



Poured from a Gas-fired rotary type smelter, frit batch is quenched at A. O. Smith plant.

With glass lining fused to steel, tank emerges from car-bottom type Gas-fired furnace.

Examination of interior best illustrates the contributions of controlled Gas-heat in fusing glass-to-steel.



GLASS AND STEEL FUSED WITH GAS HEAT form the mammoth sanitary storage tanks required by the brewing and beverage industries. Manufactured by A. O. Smith Corporation, Milwaukee, Wisconsin, these tanks, with capacities in the thousands of gallons, give graphic proof of the role GAS plays in industrial processes.

Steel sheets are welded into a single-piece tank and fittings installed. Sandblasted clean, the inside is sprayed with "slip" prepared from frit batches made in Gas-fired rotary type smelters. Dried by forced, filtered, Gas-heated air, the unit is ready to fire.

The furnace used for fusing, 56′ long, 17′ high and 15′ wide, is directly Gas-fired from 40 burners of about 1,000,000 Btu/hr input each. This furnace brings tanks well above the critical temperature of steel in the firing and fusing cycle. Inert gases pressure-forced into the tanks keep them from collapsing of their own weights, and maintain proper shape during quenching, as well as improving glass-surface quality.

Tanks are air-quenched. The precise temperature control afforded by GAS assures a flawless glass surface. Mirror smooth, the glass can bend within the elastic limits of the steel.

Why is Gas so useful in industrial applications like this? Because Gas is so readily adaptable to the demands of special processes like glass-to-steel fusion—because Gas permits rigid temperature control in critical operations. Your Gas Company Representative knows the facts. Call him today.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N.Y.

BRIDGEPORT BRASS COMPANY
CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN

"Bridgeport" MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL

Preventive Maintenance Helps To Attain High Production

Corrosion and fouling are two of the greatest offenders in petroleum refining. Corrosion shortens the life of the equipment while fouling builds up coatings of "gunk" and scale which reduce the heat-transfer rate and often accelerate corrosion.

The established practice of operating equipment beyond its rated capacity, in order to obtain maximum production levels, may have a very destructive effect on service life of equipment.

Importance of Keeping Heat Exchangers Clean

Recognizing that corrosion and fouling are major menaces to production and profit, most of the petroleum refineries keep staffs of trained people to carry on a program of periodic inspection and preventive maintenance.

Careful records are kept of the performance and life of each piece of equipment, the nature and volume of the product; the cooling or heating medium; the composition of the tubes; the character of the corrosion and its effect on the life of the tubing. These records, built up over a period of years, indicate the expected tube life. Consequently, replacements can be made before failures actually occur.

Periodic inspections are made on each piece of equipment. The ones giving the greatest trouble are inspected more frequently. New equipment is thoroughly overhauled and inspected within a few months or at most within a year after it is put into operation to learn how it is standing up and to estimate its probable service life.

Corrosion Prevention from the Product Side

Refined petroleum products in themselves are not corrosive. Sour crudes, however, carry corrosive elements such as sulphur compounds, salts (mainly sodium and magnesium chlorides), and ammonia compounds. Salts are especially troublesome since they precipitate out and form a hard crust on the tube wall and are exceptionally corrosive to stainless steel. The establishment of a desalting process for treating all crude before it enters the equipment has reduced or eliminated this problem.

Where it is not practical to remove the sulphur, alloys and metals that resist sulphur corrosion are used. Arsenical Admiralty and arsenical Muntz are satisfactory when the concentration of other corrosive elements is not excessive. Sometimes Duplex Tubing with aluminum to the product side and arsenical Admiralty to the water side, may solve this problem.

Accumulation of trash on inlet ends of tubes in salt water cooled surface condenser.

For excessive ammonia, Duplex Tubing with steel to the product side and arsenical Admiralty or some other copper-base alloy to the water side, is recommended.

Fouling Accelerates Corrosion

The clogging of tubes and equipment with marine growth, which becomes especially troublesome in warm weather when circulating sea water is used, is retarded by chlorination. This is done periodically during each shift and varies with the season.

Severe storms which disturb the water and bring in silt and eel grass are surprisingly costly. Eventually the silt is removed by the force of cleaner water and by flushing, but eel grass, which may pass through the strainer plates and one or two passes of a large surface condenser, may mat on the tube sheet leading to the third or fourth pass and reduce circulation to a dangerously low level. Here only a complete shutdown and mechanical removal of the grass are called for.

The application of heat to most crudes causes the precipitation of carbonaceous compounds. These cling tenaciously to all metal surfaces and quickly build up heat insulating layers which reduce the heat transfer properties of the tube wall.

Overheating the tubes may lead to accelerated corrosion and, in cases where the circulating water is blocked off, the tubing may also be distorted by thermal stresses.

In order to determine the cleaning cycle, which is most economical, tests are made periodically to ascertain heat and capacity losses. This is plotted against the cost of cleaning and the downtime capacity loss. When the composite curve of these values begins to flatten out, the cleaning cycle is determined and scheduled.

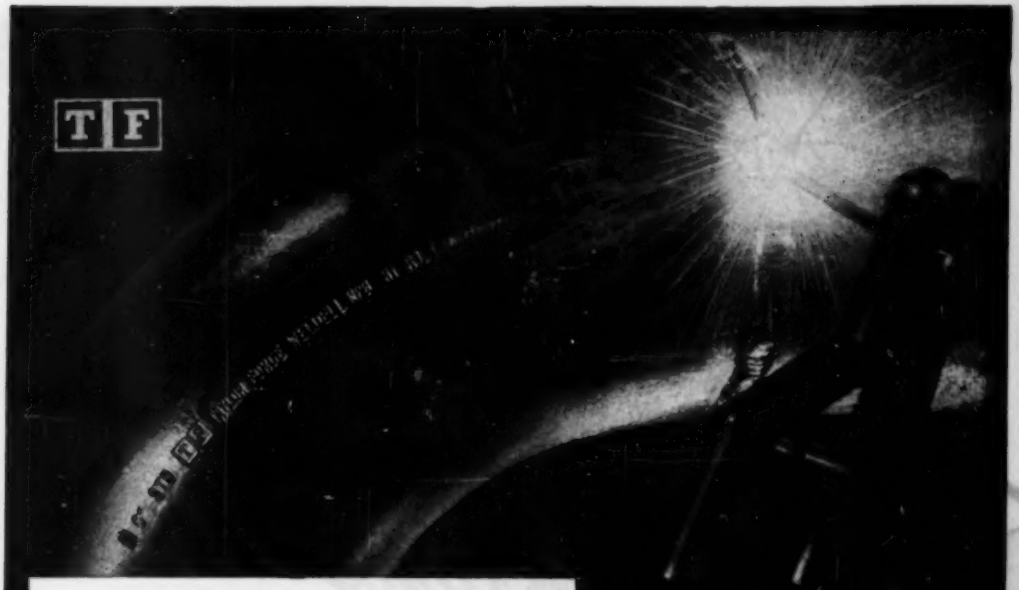
Where the deposit is hard and cannot be easily removed by solvents or acids, the condenser or heat exchanger tube bundle is cleaned inside and outside by high pressure water containing an abrasive such as sharp sand. Certain types of deposits are very effectively removed by steam cleaning or by circulating inhibited acids or other solvents.

Research

Constantly changing operating conditions increase the difficulty of fighting corrosion. Each batch of sour crude generally varies from the preceding one and requires special treatment. Circulating sea water, especially from harbors or at the mouths of rivers, tends to become more corrosive.

Operating engineers recognize that there is a difference in the behavior of various metals and often have one or more installations in trouble spots designed for experimental purposes.

Instead of using tubes of one alloy, three or more different kinds of alloys are installed in the tube bundles, properly identified, so that individual ones can be pulled out from time to time for examination. Results obtained are helpful in determining which alloy should be used when retubing. (6709)



...easier and better the WeldELL way

For the *practical* facts about pipe welding fittings go to the *practical* men...the welding foreman; the pipe fitter foreman; the construction superintendent... who have used all kinds and know the field.

They will tell you that the job moves faster and costs stay down when WeldELLS and other Taylor Forge fittings are used

...because of the precision quarter markings, the sized end tangents, the accurate machine tool bevels and lands.

They will tell you that the job maintains momentum easier, smoother

...because of the completeness of the line and better identification markings.

They can tell you...at least, design men will...that the *finished* job is better

...because it is done with fittings that are engineered down to the last detail to meet all requirements of *every job.*

Yes, "WeldELLS have everything"...to make it *easier ...better.* Coupon brings lots of facts.

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TAYLOR FORGE & PIPE WORKS • *General Offices & Works:* Chicago 90, Ill. (P.O. Box 485). *Eastern Plant:* Carnegie, Pa. *Western Plant:* Fontana, Calif. *District Offices:* New York: 50 Church Street. Philadelphia: Broad Street Station Bldg. Pittsburgh: First National Bank Bldg. Chicago District Sales: 208 S. LaSalle Street. Houston: City National Bank Bldg. Los Angeles: Subway Terminal Bldg. San Francisco: Russ Bldg.

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how to prevent the wrong reaction . . . .

. . . the Versenes*

VERSENE* — THE OUNCE OF PREVENTION

The wrong reaction in chemical processes always spells trouble with a capital "T." This kind of trouble is always expensive. It creates confusion, costs money, wastes time, spoils goods, reduces yields, loses business and wipes out good will. The intelligent use of one or more of the Versenes can *prevent* wrong reactions caused by certain things such as metallic impurities or contaminants in commercial grade chemicals and equipment.

HOW THE VERSENES* WORK

The Versenes are the tetra sodium salts of ethylene diamine tetra acetic acid and other polyamino acids. They are among the most versatile and powerful chelating (complexing) agents known. They complex any di- or tri-valent metallic ions efficiently and economically and are completely stable in hot alkaline and acid solutions. The Versenes react with most metallic ions to form soluble non-ionic metal chelate compounds. These powerful, complex compounds inactivate the metallic ions so completely that they cannot be precipitated by common precipitating agents. 500 grams of dry, or 1500 grams of liquid Versene will complex one mole of metallic ions.

VERSENES* ARE AVAILABLE

There are now 7 Versenes. Each has special applications but all help give the *right* reaction every time — despite metallic contaminations. A clue to your problem places a generation of experience in pioneering the polyamines at your disposal. Send for Technical Bulletin #2. Samples on request. Write Dept. B.

"industry's most modern chemicals"

NEW VERSENE WATER TEST KIT. Tells total hardness in 2 minutes. Accurate to one grain per gallon. Versenate Method. Complete Kit $5.00 postpaid.

*Trade Mark

BERSWORTH CHEMICAL COMPANY

FRAMINGHAM, MASSACHUSETTS

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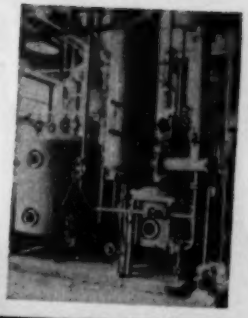
Improve Plant Performance

...REDUCE INSULATING COSTS

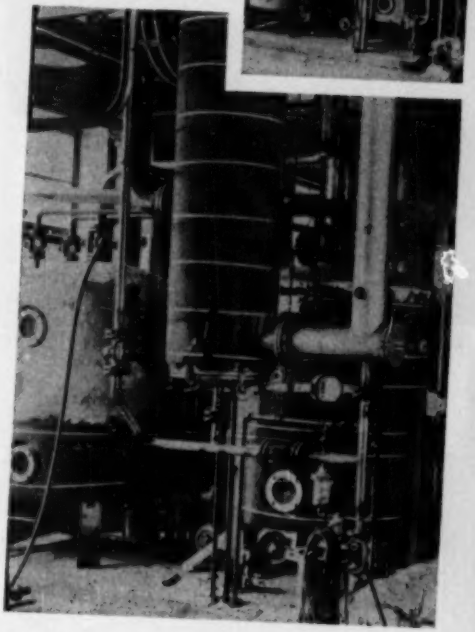
When you improve temperature control you can run your plant more efficiently. With PC Foamglas you can control temperatures more exactly, more economically.



Here's why: Since it consists of still air sealed in minute glass cells, Foamglas is an excellent barrier to heat transfer. Glass has unusually high resistance to many elements that cause insulation to deteriorate. Consequently, long lasting, trouble free service, makes Foamglas the least expensive insulating material.

PC Foamglas is available in standard flat blocks, curved segments and beveled lags, to fit equipment sides, heads and domes, and in preformed sections for standard size pipe and fittings.

We invite you to send in the coupon for a sample of PC Foamglas, and for free literature containing complete information.



This typical equipment, used in a process where temperatures range from 0°F. to 200°F., is insulated with curved segments of PC Foamglas. Insulation Contractor: Combustion Equipment & Insulation Company, Cleveland, Ohio.

PITTSBURGH CORNING CORPORATION, PITTSBURGH 22, PA.

The **best** glass insulation is cellular glass. The **only** cellular glass insulation is PC Foamglas. This unique material is composed of still air, sealed in minute glass cells. It is light-weight, incombustible, verminproof. It has unusually high resistance to moisture, chemicals and many other elements that cause insulation to deteriorate.

Pittsburgh Corning Corporation
Dept. CC-61, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me without obligation a sample of Foamglas and your FREE booklet on the use of PC Foamglas for Industrial Insulation.

Name .....

Address .....

City ..... State .....

PITTSBURGH ® PC CORNING

FOAMGLAS cellular glass INSULATION

...when you insulate with FOAMGLAS... the insulation lasts!

BAKER PLATINUM LABORATORY WARE

No more exacting tests could be applied to any product than those to which our platinum laboratory ware is subjected. The tests are continuous, because we maintain and operate large scientific laboratories and naturally employ our own laboratory ware in them.

The consequence is that any divergence from our high standards, any defect in manufacture, would show up inevitably.

All this makes it doubly safe for you to adopt Baker Laboratory Ware as standard equipment. You can't possibly go wrong in choosing it.

BAKER & CO., INC.

113 Astor St., Newark 5, N. J.

NEW YORK 7 CHICAGO 2

SAN FRANCISCO 2

Some important facts about GALVANIC CORROSION and how you can control it

With strict conservation of basic defense materials again the order of the day, this brief discussion of bi-metallic corrosion may save you a few unnecessary headaches

When two dissimilar metals are coupled in a corrosive liquid – brine, for example – one metal is often attacked by corrosion at a faster rate than usual.

The second metal may remain free from attack. Or it may be corroded at a slower rate than usual.

This type of corrosion is known as "galvanic corrosion."

What to look for

Before blaming galvanic action for corrosion in your equipment, you should first determine whether these three conditions exist:

1. **Are the metals different?**
2. **Are they surrounded by an electrolyte?**
3. **Are they in electrical contact through a metallic path?**

A "yes" answer to all three questions should send you to the "Galvanic Series" chart reproduced at the right. Here the metals are listed in the reverse order of their "nobility" or resistance to galvanic corrosion.

Galvanic corrosion usually results in a higher rate of corrosion of the "less noble" metal, and protection of the "more noble" metal.

How to use the chart

Notice how the metals are grouped. Any metal in one group can safely be used with any other metal in its own group. When you start mixing metals from different groups, however, you may run into serious galvanic corrosion of the metal higher on the list. And the further apart the metals stand, the worse this corrosion may be.

Another thing to consider in using different metals, too, is the electrical contact between them. When the metals are separated or insulated in some way, galvanic corrosion is checked.

And a third factor to keep in mind is the relative areas of the two metals. If they are in contact with each other, make sure that the parts having the smaller area are more noble than those having the larger area.

Application

With these principles as a guide, you can tell which metals are apt to produce strong galvanic corrosion. And you can tell which are relatively safe to use in contact with each other. For example, Monel fastenings could be used on a steel tank holding a liquid without fear of galvanic corrosion.

Why? Because the relative areas of the two metals are such that the area of the less noble metal, steel, is much greater than that of Monel. Since the magnitude of the galvanic action depends to a large extent on this area ratio, corrosion in the steel will not be accelerated to any appreciable extent.

Two good suggestions

1. Write for our free booklet, *Corrosion—Processes, Factors, Testing.* It contains a thorough explanation of galvanic corrosion, with data on the characteristics of Monel, Nickel and Inconel.

2. If you have a metal problem, take it up with INCO's Corrosion Engineering Service. Available data from their files for a particular combination of metals will be furnished wherever possible. And Corrosion Engineering will be glad to help you apply general principles of galvanic corrosion control to your specific problems.

GALVANIC SERIES OF METALS AND ALLOYS

Corroded End
(anodic, or least noble)

▼

Magnesium
Magnesium alloys

▼

Zinc

▼

Aluminum 25

▼

Cadmium

▼

Aluminum 175T

▼

Steel or Iron
Cast Iron

▼

Chromium-iron (active)

▼

Ni-Resist

▼

18-8 Stainless (active)
18-8-3 Stainless (active)

▼

Lead-tin solders
Lead
Tin

▼

Nickel (active)
Inconel (active)

▼

Brasses
Copper
Bronzes
Copper-nickel alloys
Monel

▼

Silver solder

▼

Nickel (passive)
Inconel (passive)

▼

Chromium-iron (passive)
18-8 Stainless (passive)
18-8-3 Stainless passive)

▼

Silver

▼

Graphite
Gold
Platinum

▼

Protected End
(cathodic, or most noble)

EMBLEM OF SERVICE INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

Who's the big wheel in gas compressors?

That depends on who you're listening to.

But these are facts.

Carrier Corporation has been making multi-stage centrifugal compressors for 30 years.

Our total production to date is over 2000 machines.

We don't know of any other company who's made nearly as many.

Those are facts... and you can't argue with them.

Of course, we think that the reason we've made so many compressors is that we make the best compressor.

That you may not agree with... until you've owned one.

For more facts, write Carrier Corporation, Syracuse 1, N. Y.

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

Modern equipment and manufacturing techniques help make Carrier the big wheel in gas compressors.

Many of the men who built the first Carrier Compressor 30 years ago are still building them today.

WHERE you get it... DOES make a difference

When you place your order with Barrett you're assured prompt, dependable service and top quality products, backed by 96 years of successful manufacturing experience.

WHEN YOU NEED A COAL-TAR CHEMICAL — GET IT FROM...

- Phenols
- Cresols
- Cresylic Acids
- Chlorinated Tar Acids
- Xylenols
- Pickling Inhibitors
- Benzol
- Toluol
- Xylol
- Naphthalene
- Hi-Flash Solvent
- Phthalic Anhydride
- Dibutyl Phthalate
- ELASTEX* DCHP Plasticizer
- "ELASTEX" 10-P Plasticizer
- "ELASTEX" 50-B* Plasticizer
- "ELASTEX" 28-P Plasticizer
- Phenolic Resins
- Niacin (Nicotinic Acid)
- Pyridines
- Picolines
- Quinoline
- Lutidines
- Tar Acid Oils
- Neutral Coal-tar Oils
- Coal-tar Creosote
- CUMAR* Paracoumarone-Indene Resin
- Carbonex* Rubber Compounding Hydrocarbon
- Bardol* Rubber Compounding Oil
- Flotation Agents

*Reg. U. S. Pat. Off.

Barrett

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

NEW from GARLOCK

Packings and Gaskets made of *Teflon**

*Teflon is the Du Pont Company's trademark for tetrafluoroethylene resin.

The Packing and Gasketing Material that

IS ENTIRELY UNAFFECTED BY ANY ACID, ORGANIC SOLVENT OR ALKALI SOLUTION

GARLOCK 8764 . . . *a rod, shaft or flange packing made of* Teflon *powder molded to required size and shape. Available in ring, sheet, gasket, tape, disc or cup form. Also used for making envelopes for gaskets.*

GARLOCK 5733 . . . *a "Lattice-Braid" rod or shaft packing made of* Teflon *filament. Supplied in coil or ring form.*

GARLOCK 9100 . . . *a plastic rod or shaft packing made of shredded* Teflon. *Supplied in coil or ring form.*

Exhaustive tests in the GARLOCK laboratories and in the field have proved that *Teflon* is the only *wholly* satisfactory material for sealing against acids, organic solvents, and other chemicals.

GARLOCK packings and gaskets made of *Teflon* are entirely unaffected by acids and are completely resistant to all organic solvents and alkali solutions. They are suitable for use at operating temperatures from below −90° F. up to 500° F. Within that temperature range these packings and gaskets *retain* their inherent toughness, have a *low* coefficient of friction, and do *not* react with metals of construction.

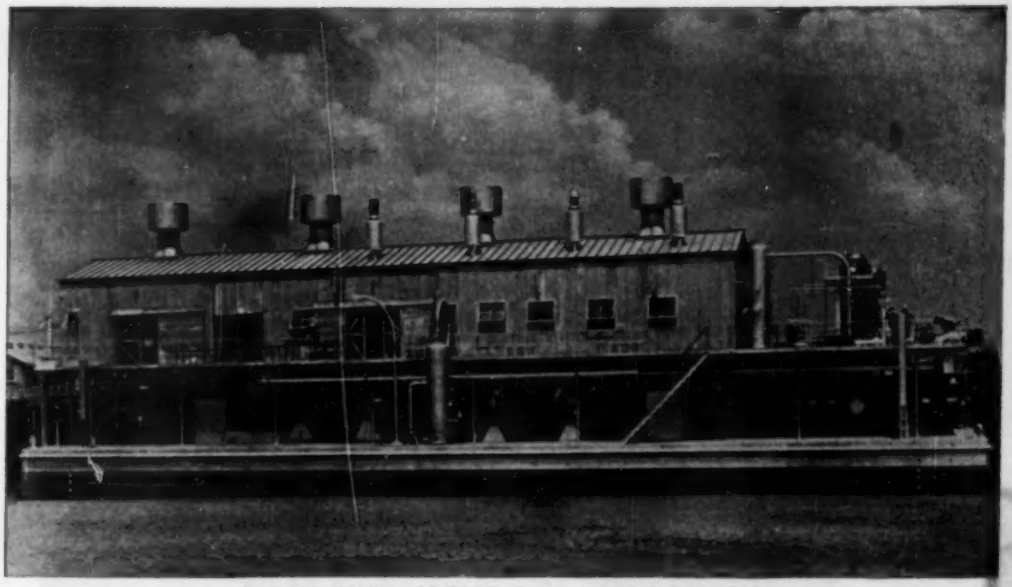
Wherever resistance to chemicals is a *requisite*, specify GARLOCK's *Teflon* packings for use on valves, pump rods or shafts and *Teflon* gaskets for all types of flanged joints.

Write for this new Catalog!

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK



Developed by Bethlehem and Gulf Refining Company engineers, the first completely integrated Submersible Compressor Barge was built by Bethlehem's Beaumont Yard.

Bethlehem's Submersible Compressor Barge

For the Most Economical Working of Low Pressure Natural Gas in Shallow Water or Marshland

Length, 128 ft Width, 36 ft Depth, 10 ft

Five 300 hp Compressors

Daily Capacity 15,000,000 cu ft at 800 psi pressure.

- ★ Completely Integrated . . . Ready to Hook up to the Well.
- ★ Eliminates Need for Costly Erection Crews Miles from their Base.
- ★ Eliminates Need for Expensive Pile and Concrete Platforms.
- ★ Mobility, if and when Necessary.
- ★ 100 Per Cent Salvage.

Our engineers will be happy to supply further details on request.

SHIP REPAIR YARDS

Boston Harbor	New York Harbor
Baltimore Harbor	Beaumont, Texas
Los Angeles Harbor	San Francisco Harbor

SHIPBUILDING YARDS

Quincy, Mass.	Staten Island, N. Y.
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SHIPBUILDERS ***SHIP REPAIRERS***

BETHLEHEM STEEL COMPANY

Shipbuilding Division

General Offices: 25 Broadway, New York 4, N. Y.

On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation

Now CMH *offers*

a proved expansion joint for pressures up to 5500 psi

Advancements in the design of the CMH FLEXONIFLEX Expansion Joint—the "proved-in-service" high pressure expansion joint—now make it possible to offer units for working pressures up to 5500 psi. For all power and process applications it means that the advantages of compact, easy-to-install expansion control may be used at pressures far beyond those which had previously been considered safe.

Standard FLEXONIFLEX units have bellows type stainless steel pressure carriers, single or multiple ply, lined or unlined with integral control rings and end sections. Sizes range from $\frac{5}{8}$" through 6" I.D., although larger sizes can be furnished. Suitable for temperatures from sub-zero to 1600° F. (higher with special materials).

For specific recommendations send complete details of your application.

OTHER CMH EXPANSION JOINTS

For low and medium pressure service you may take advantage of the same engineering skill that has developed FLEXONIFLEX units. CMH Controlled-Flexing Expansion Joints are available in copper or stainless steel for pressures up to 300 psi, sizes to 48" I.D. CMH Free-Flexing Expansion Joints are also available in copper or stainless steel for pressures up to 30 psi, sizes to 48" I.D. Larger sizes are available in both types for special applications.

Flexon identifies CMH products that have served industry for over 48 years.

CHICAGO METAL HOSE Corporation

1317 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

CMH

ONE DEPENDABLE SOURCE
for every flexible metal hose requirement

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems • Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of Hose, Compensators

See Our Catalog in Sweet's File

CHAPMAN

Steel Valves Score on all 3 Points

1
CHAPMAN STEEL VALVES have the high precision ratings of custom-made valves — but the economy of production-line manufacture.
2
CHAPMAN STEEL VALVES are made exclusively from quality-controlled steels developed and produced in Chapman's own foundries under control of Chapman's own outstanding metallurgists.
3
CHAPMAN STEEL VALVES are designed to equal or surpass — A.S.A. and A.P.I. Standards in all pressures and temperature ranges.
CHAPMAN
STEEL

Be sure to see Chapman first whenever you need steel valves — gate, globe, angle or check. As a result of Chapman's long years of research and experience, they are tops in every respect.

The Chapman Valve
MANUFACTURING COMPANY
INDIAN ORCHARD, MASS.

AVAILABLE FOR YOUR NEEDS . . . ANYWHERE

GLOBE TUBES

GLOBE

PRECISION-PROCESS SEAMLESS WELDING FITTINGS

Nation-wide availability through key distribution centers is yours when you specify Globe Welding Fittings.

For the finest in seamless welding fittings and a dependable source of supply, look to Globe and your Globe distributor.

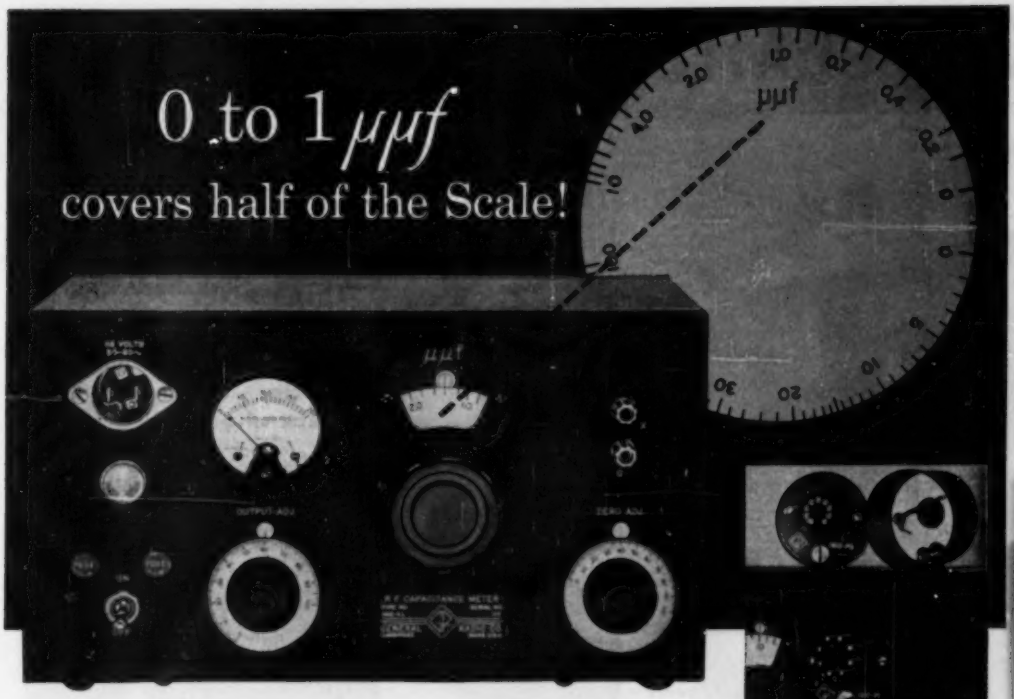
For complete information on sizes and types, send for the Globe Welding Fittings Catalog.

Globe Steel Tubes Co., Milwaukee 46, Wis.

Chicago • Cleveland • Detroit • New York • Philadelphia
St. Louis • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

0 to 1 $\mu\mu f$ covers half of the Scale!



The measurement of very small capacitances at radio frequencies is sometimes a difficult problem. To simplify this important measurement, G-R has developed the Type 1612-AL R-F Capacitance Meter, having two ranges from zero to 10 micromicrofarads and zero to 100 micromicrofarads.

Compact, very simple-to-use, accurate and reliable, this new meter fills a demand for many measurements of small capacitances such as:

Ceramic Capacitors — tubular ceramics (insulated and uninsulated), disc-type ceramics, tubular ceramics included in v-t sockets

Molded Mica Capacitors — foil- or silver-mica

Variable Trimmer Capacitors — variable mica, variable plate-type, variable multi-cup-type air, variable ceramic, and variable piston-type with glass dielectric

Vacuum-Tube Sockets

The operation of the instrument is very simple. Merely: (1) set the main dial to one of its two zero points, (2) turn "Zero Adjust" dial for maximum meter reading, (3) turn "Output Adjust" dial for full-scale reading on meter. Connect the unknown to the "X" terminals and retune the main dial to obtain maximum meter reading. The capacitance of the unknown is then indicated directly by the main dial setting.

The capacitance accuracies are: LOW RANGE of 0 to 10 $\mu\mu f$: ± 0.03 $\mu\mu f$ below 1 $\mu\mu f$, and $\pm 3\%$ between 1 and 10 $\mu\mu f$; HIGH RANGE of 0 to 100 $\mu\mu f$: ± 0.3 $\mu\mu f$ below 10 $\mu\mu f$, and $\pm 3\%$ between 10 and 100 $\mu\mu f$.

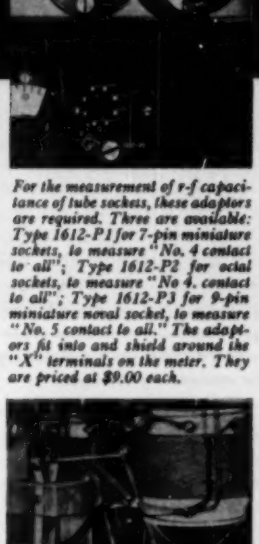
On the 10 $\mu\mu f$ range, the first $\mu\mu f$ occupies almost one-half of the scale length, and settings can be made to 0.002 $\mu\mu f$!

In addition, the meter can be used to approximate the dielectric loss by observing the amount by which the final tuning adjustment during measurement fails to reach full-scale on the indicating meter.

Together with its companion Type 1612-A R-F Capacitance Meter (with ranges of 0 to 1200 $\mu\mu f$ and 0 to 80 μf) this new meter provides an unusually simple, accurate and direct method for measuring capacitances over a very useful range, at radio frequencies.

TYPE 1612-AL R-F CAPACITANCE METER ... $170
TYPE 1612-A R-F Capacitance Meter 170

For the measurement of r-f capacitance of tube sockets, these adaptors are required. Three are available: Type 1612-P1 for 7-pin miniature sockets, to measure "No. 4 contact to all"; Type 1612-P2 for octal sockets, to measure "No 4. contact to all"; Type 1612-P3 for 9-pin miniature noval socket, to measure "No. 5 contact to all." The adaptors fit into and shield around the "X" terminals on the meter. They are priced at $9.00 each.



In shifting from one range to another, no extra panel switching is required. The change in range is accomplished automatically as the dial is rotated from one half of the scale to the other, the switch shown above automatically performing the operation.

GR

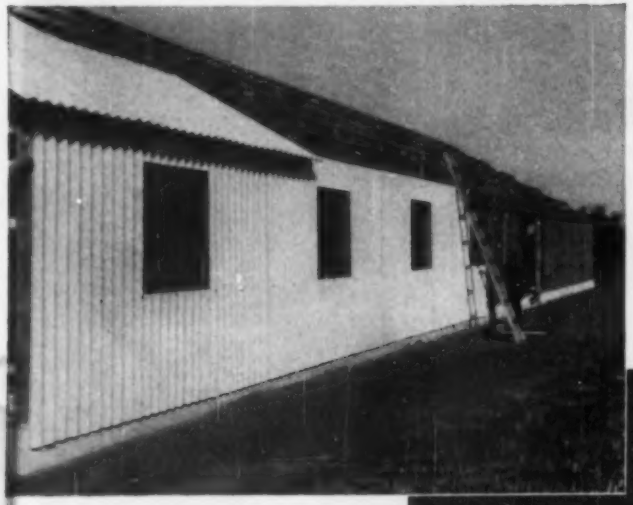
GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Mass.

NEW YORK 6 ... CHICAGO 5 ... LOS ANGELES 38

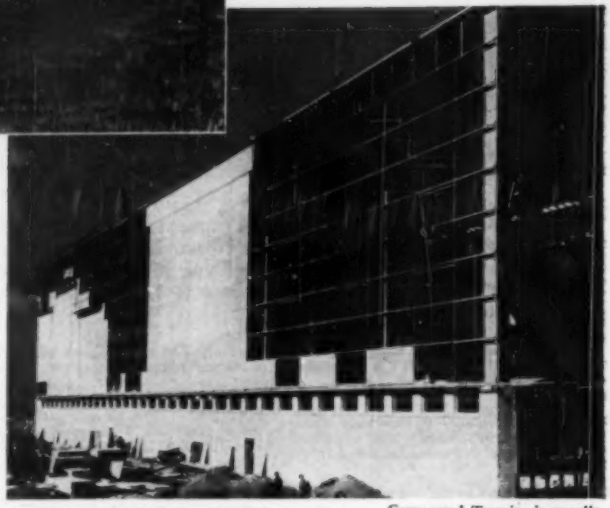
CORRUGATED TRANSITE* . . . *for defense and industrial expansion*

*Transite is a registered Johns-Manville trade mark



Because it goes up fast, requires a minimum of framing, Corrugated Transite is ideal for defense installations.

Transite sheets can't burn, rot, or rust—and they're not expensive!

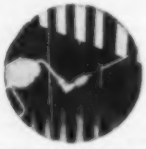


● Whether your expansion requirements are large or small, it will pay you to investigate the many advantages of Corrugated Transite. The large easy-to-handle asbestos sheets with their unusual strength provide durable, weatherproof walls and roofs. With a minimum of framing, they are quickly and easily applied, construction costs are lowered and when alterations are necessary they can be completely salvaged.

You save on maintenance, too. Made of asbestos and cement, practically indestructible materials, Transite requires no preservatives . . . eliminates upkeep . . . can't burn, rot or rust!

In addition to its superior functional advantages, Corrugated Transite is being used increasingly because of the modern streamlined appearance it gives any exterior or interior. For full information write Johns-Manville, Box 158, Dept. FM, New York 16, N. Y.

Corrugated Transite is equally effective in constructing the small wood frame warehouse (upper left) and expanding the large steel framed aviation plant (lower right).



EASY TO FASTEN TO STEEL

EASY TO SAW

EASY TO DRILL

EASY TO NAIL TO WOOD

Johns-Manville *Asbestos* **CORRUGATED TRANSITE**

Instrument NEWS

B. F. Goodrich Adds G-E Mass Spectrometer To New Research Facilities

B. F. Goodrich scientists say their General Electric mass spectrometer will get solutions to new problems plus new approaches to old problems. The creation of new products will be speeded by the G-E instrument, they say. The G-E spectrometer was purchased in line with the B. F. Goodrich policy of using the latest scientific equipment.

With automatic operation and immediate high-speed pen recording, results are obtained at once. A wide range permits work on most chemical compounds. General Electric offers complete advisory service to present and prospective users, including analysis of compounds.

G-E Dewpoint Recorder . . .

. . . used for checking moisture content of charged cylinders of nitrogen, oxygen, etc., in plant of the National Cylinder Gas Co., in Chicago, Ill.

Electron Diffraction Instrument Speeds Surface Analysis

An operator in an industrial laboratory, studying surface phenomena, removes plate holder from camera.

Analysis of thin fibers and surface coatings are greatly facilitated with the G-E electron diffraction instrument, especially in cases where X-ray diffraction techniques fail because of too-deep penetration.

The instrument is proving to be a valuable tool wherever a knowledge of the chemistry of solid surfaces is required. It is being used to study all types of surface phenomena and is applied to research, development, and control work.

Articles to be tested are inserted in this specimen chamber, shown with door open.

Ten Photoelectric Recorders Used at Battelle Institute

Battelle Institute, Columbus, Ohio, is now using ten General Electric photoelectric recorders in its industrial-research laboratory.

Some of the recent applications for which photoelectric recorders have been used at Battelle are: differential thermal analysis, and recording short-time high-temperature creep qualities of various metallic and plastic substances. It is also used as a sensitive recording instrument for use in measurement and non-destructive testing where it responds to, and signals from devices such as: ionization gages, photoelectric cells, thermocouples, transducers, and strain gages.

The Type CE photoelectric recorder measures d-c volts or amperes directly, and will record almost any quantity that can produce a d-c signal which varies in proportion to the quantity being measured. Chart speeds range from ½ inch per hour to 72 inches per minute; sensitivities are as high as 1.0 microampere full scale; response periods as fast as ⅛ second for full-scale deflection.

SECTION B687-75 GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Please send me the following bulletins:

- ☐ GEC-656 Electron Diffraction Instrument
- ☐ GEC-696 mass spectrometer tubes and components
- ☐ GEC-587 mass spectrometer
- ☐ GEC-588 dewpoint equipment
- ☐ GEC-254 Type CE photoelectric recorder

NAME ..... (PLEASE PRINT)

COMPANY .....

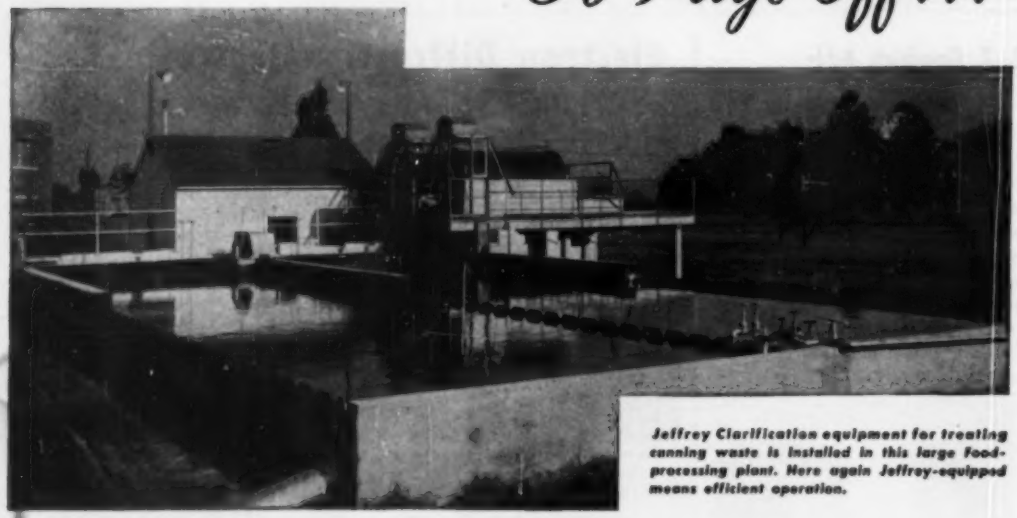
STREET .....

CITY ..... ZONE ..... STATE .....

GENERAL ELECTRIC

TREAT INDUSTRIAL WASTE RIGHT

It Pays Off...



Jeffrey Clarification equipment for treating canning waste is installed in this large food-processing plant. Here again Jeffrey-equipped means efficient operation.

Industrial Waste is the Peck's Bad Boy in nearly every plant . . always in bad with the neighbors as well as State Pollution Control Commissions.

Clarification of industrial waste need not be such a bad problem. Jeffrey has the facilities for proper and efficient waste treatment . . can help you keep the nation's waters clean. For meeting exacting specifications we can furnish Collector mechanisms for Grit Chambers and Settling Basins, Screens, grease and oil Skimmers, Flocculation equipment, etc., backed by years of experience in designing and building the best in Sewage and Water treatment equipment.

We will be glad to send you some of the names of outstanding plants in which Jeffrey equipment is doing a real job on the purification of sewage and concentrated organic wastes . . and paying off. May we hear from you?

Bar and Disc-type Screens
Sludge Collectors
Sludge Elevators
Grit Washers and Collectors

FLOCTROLS (controlled flocculation)
Equipment for Biofiltration plants
Transmission Machinery
Scum Removers
Garbage Grinders

Chemical Feeders
Screenings Grinders
Belt and Spiral Conveyors
Chains and Sprockets

THE JEFFREY MANUFACTURING COMPANY Established 1877

909 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

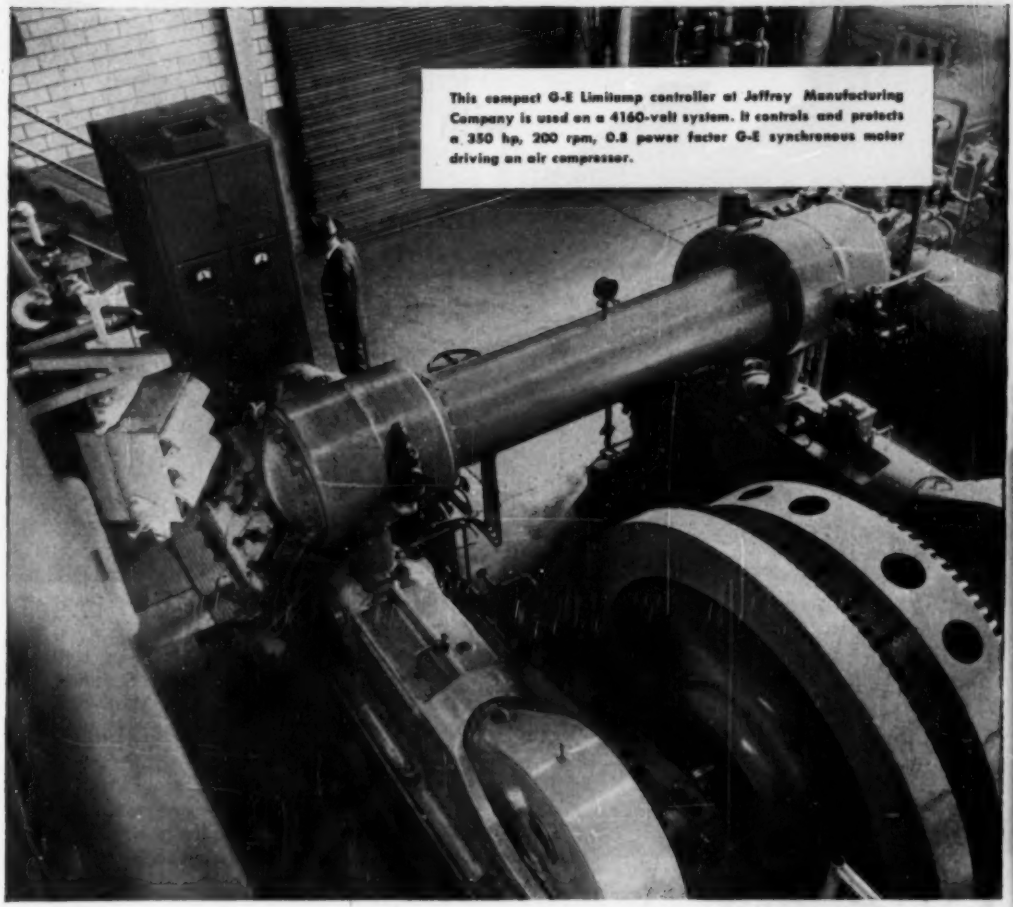
JM

Baltimore 2, Beckley, W. Va., Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 15, Denver 2, Detroit 13, Horlan, Ky., Houston 2, Jacksonville 2, Milwaukee 2, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 1, Salt Lake City 1, Scranton 3

Jeffrey Mfg. Co. Ltd., Montreal, Canada
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S.A.
The Ohio Malleable Iron Co., Columbus, Ohio

British Jeffrey-Diamond Ltd., Wakefield, England
The Galion Iron Works & Mfg. Co., Galion, Ohio
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

Jeffrey Manufacturing Uses G-E Limitamp Control



This compact G-E Limitamp controller at Jeffrey Manufacturing Company is used on a 4160-volt system. It controls and protects a 350 hp, 200 rpm, 0.8 power factor G-E synchronous motor driving an air compressor.

This high-voltage control meets a need for ample interrupting capacity, protection for operating personnel, good appearance and compactness

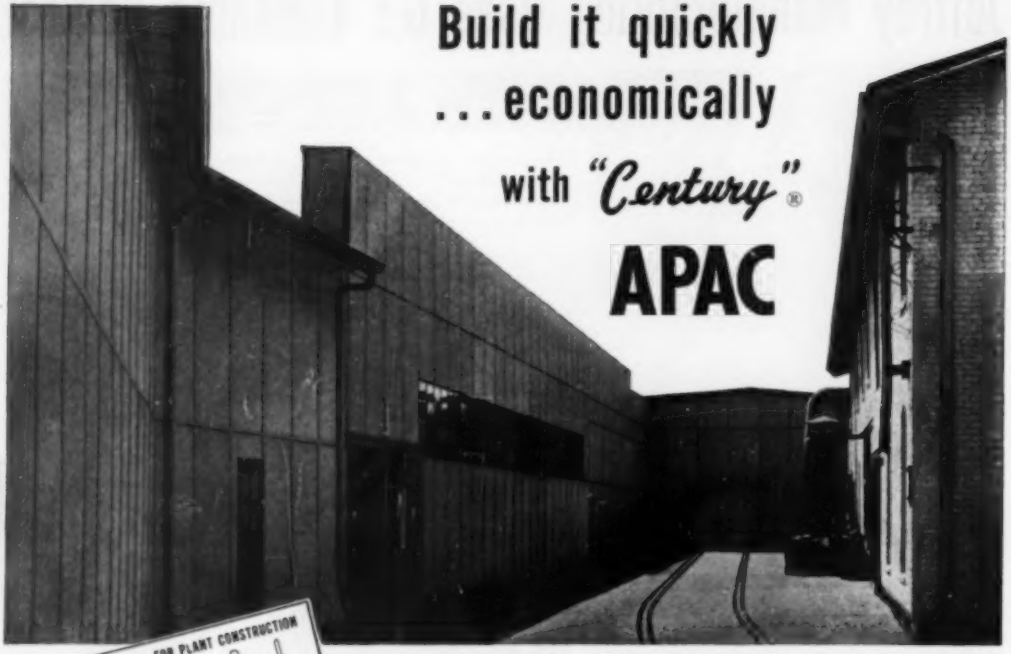
The addition of a large compressor for general plant use called for a synchronous motor and dependable high-interrupting-capacity control at Jeffery's modern power house. In addition to the accurate synchronization obtained with the new field control of this air-break Limitamp controller, and the factors mentioned above, Jeffrey likes the co-ordinated design of this G-E controller that is factory engineered and built. Such a compact, steel-enclosed controller is easily installed, requires little space—yet has all the features that provide protection for both equipment and personnel. And it's quickly inspected and maintained.

Rapid duty cycles do not affect the long life inherent in G-E Limitamp—now available in ratings up to 4800 volts with an interrupting capacity up to 250 mva. Shorts are cleared in less than half a cycle—offering positive protection for your expensive electric equipment. Write for more information on the new Limitamp controller—also available for squirrel cage and wound rotor motor control—in Bulletin GEA-5409. *General Electric Company, Schenectady 5, N. Y.*

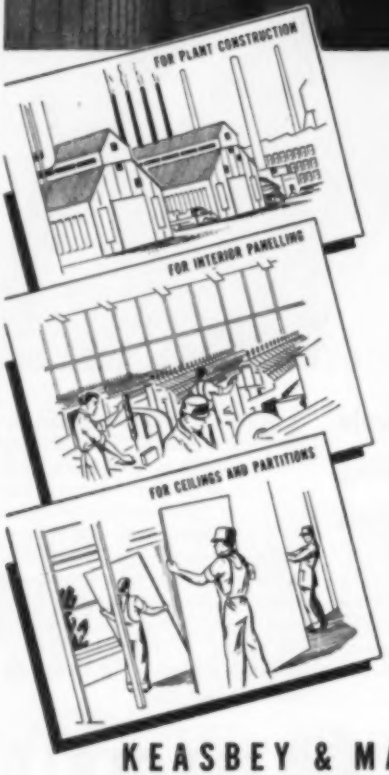
GENERAL ELECTRIC

730-27

Build it quickly ... economically with "Century"® APAC



Truck-side building with both exterior and interior walls of "Century" APAC



Whatever your construction plans—interior, exterior, new structures, or modernization—you'll build better, at less cost, with "Century" APAC . . . Keasbey & Mattison's versatile asbestos-cement structural sheet.

Consider the advantages of building with APAC: It's a low-cost material of stone-like durability. Application is quick and inexpensive: Sheets are large size (standard 4′ x 8′); are easily cut and fitted on the job; can be fastened with ordinary nails or screws. Labor costs are low.

And APAC needs but a minimum of maintenance! The all-mineral asbestos and cement composition resists weather and moisture—*can't burn*—is unaffected by rodents or termites and will not rust or rot. The attractive natural gray surface never needs protective painting!

These are just a few of the many reasons why so many plants are using "Century" APAC for siding, office panelling, fire-resistant sheathing in shops and stock-rooms, storage bins, linings for elevator casings, shower stalls —to name but a few uses. We'll be glad to send you complete information on "Century" APAC, and the name of your nearest distributor. Write us.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

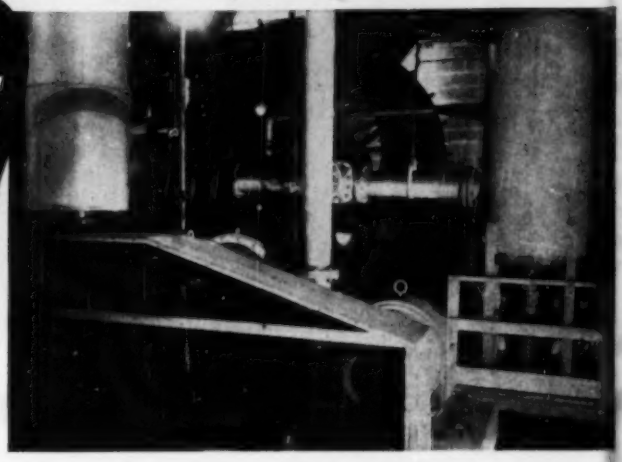
Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873

See General American for

CREATIVE DEWATERER ENGINEERING

For high speed dewatering of slurry pulp . . . AUTOMATICALLY! The CONKEY ROTARY HOPPER VACUUM DEWATERER

Designed to do your job best!



OPERATORS everywhere report highly successful results with the Conkey Rotary Hopper Vacuum Dewaterer for a wide range of materials. Some of these include aluminum tri-hydrate, barium nitrate, ground pitch, silica sand, coal, grain, TNT, Ilmenite, paper stock, gun cotton, abrasives and magnetite.

DESIGNED to take full advantage of the quick-filtering characteristics of slurries as well as the segregation tendencies of coarser, heavier solids, the Conkey Rotary Hopper Vacuum Dewaterer features relatively high drum speeds. This explains the very large capacities achieved—as in a typical installation where each Conkey Dewaterer is dewatering more than 2,000 tons of solids per day to approximately 6% moisture.

SAVES LABOR. No adjustments of feed consistency are necessary, and with continuous automatic operation, practically no supervision is required. *For complete technical information, write for Bulletin No. 101.*

Other General American Equipment:

Turbo-Mixers, Filters, Thickeners, Evaporators, Dryers, Towers, Tanks, Bins, Pressure Vessels

OFFICES IN ALL PRINCIPAL CITIES

Process Equipment Division
GENERAL AMERICAN
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Sales Office: 10 East 49th St., New York 17, N.Y.
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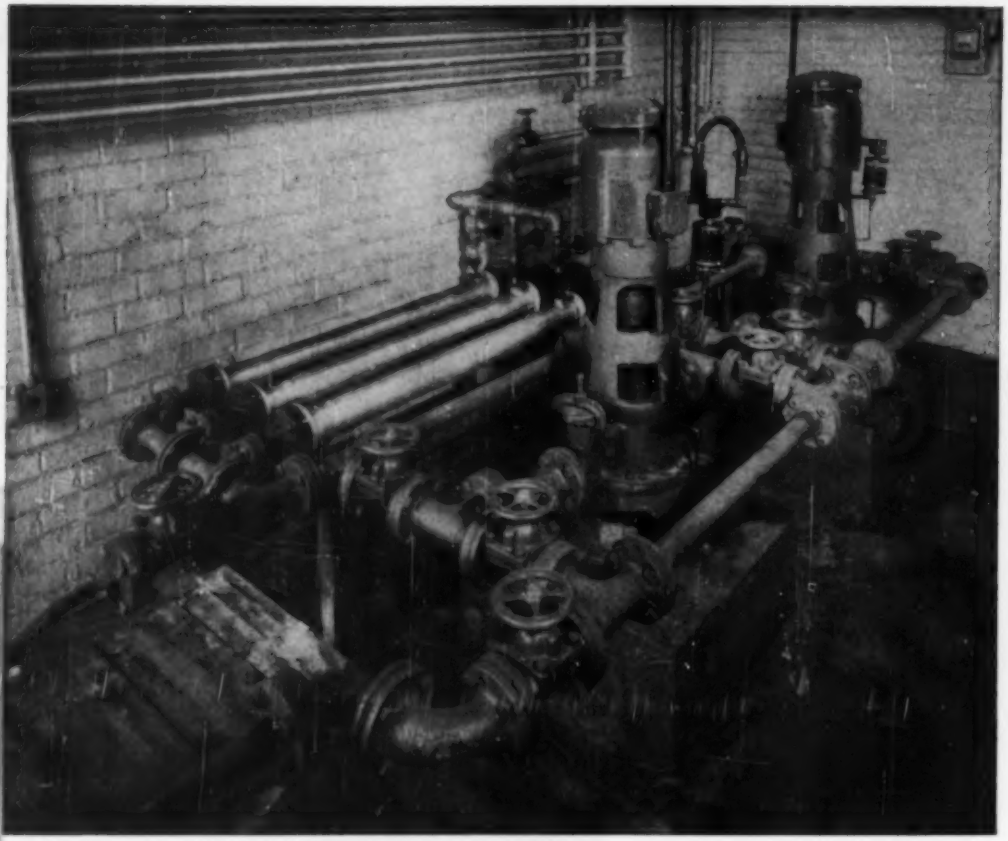


Going and Coming

These LaBour Type G (packingless) centrifugal pumps have a two-way job in a large steel mill. Part of the time they handle straight sulphuric acid; part of the time they move waste pickle liquor. The rapid priming action of the LaBours, and their positive immunity to air binding, makes this dual role entirely practical—a convenient and economical solution to a particular problem.

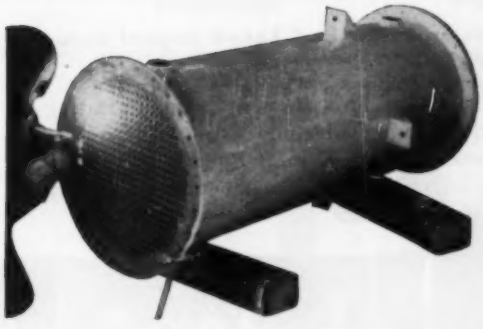
Your problem is probably different. The point we'd like to make is that LaBour pumps, because of their extra abilities, are adapted to many an application which would be impractical with less able or less dependable pumps. In the 28 years LaBour has served the process industries we've come up with a lot of answers. Why don't you ask us about *your* pumping problem?

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.

Fabricators Can Tell the Difference in *Carpenter* Stainless Tubing



All-Stainless condenser containing 481 Carpenter Stainless Tubes (¾" x 16 gauge, Type 304). The fabricator says: "We have used Carpenter Stainless Tubing for a number of years. In addition to the quality of the tubing, we like the good service we get from Carpenter's distributor."

Perfect seating on tube bundle jobs—easy bending and coiling—are advantages your fabricator can tell you about when he uses Carpenter *Heat Exchanger Quality* Stainless Tubing.

Because of the *wall uniformity* of this tubing, fabrication is not delayed by costly trial-and-error methods. Even on straight pipe line hook-ups, wall uniformity saves time in working with standard fittings and valves.

Analysis, Tolerance and Finish are guaranteed to be "as ordered" on every shipment of Carpenter Stainless Tubing.

NEW SLIDE CHART ON BENDING STAINLESS TUBING

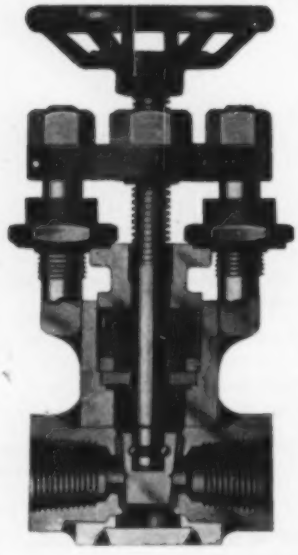
This new Carpenter service can help you conserve material, get best results with Stainless Tubing and Pipe. Covers bending radii, coil diameters for various sizes and gauges. A note on your company letterhead will bring you the new Carpenter Tubing Slide Chart.

THE CARPENTER STEEL COMPANY
Alloy Tube Division, Union, N. J.
Export Department: Carpenter Steel Co., Reading, Pa. "CARSTEELCO"

Carpenter
STAINLESS TUBING

—guaranteed on every shipment

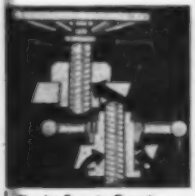
General Purpose
800# HANCOCK
Steel Gate Weldvalves



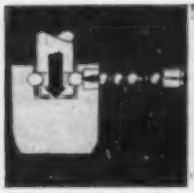
They really score with...

- ✓ **Integral stellite seats!**
- ✓ **No bonnet joint!**
- ✓ **Dissimilar materials in seats and wedges!**
- ✓ **Self-storing gland!**
- ✓ **"500 Brinell" stainless steel wedge!**
- ✓ **Stainless-to-stainless back seating!**
- ✓ **Gland nut threads protected!**
- ✓ **Ball-bearing stem-to-wedge connection!**
- ✓ **Packing ease!**
- ✓ **Interchangeable parts!**
- ✓ **Safe, comfortable handwheel!**
- ✓ **Baked enamel exterior finish!**

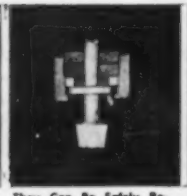
Modern in every detail, with design and operating features found in no other valve, and costing no more than ordinary valves, Hancock *General Purpose* Steel Gate WELDVALVES will take the toughest service, stay tight month-after-month.



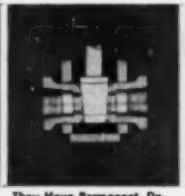
They're Easy to Operate—simple, durable Hancock yoke structure—as illustration—reduces friction to less than ½ that of conventional gate-type valves, bottom illustration.



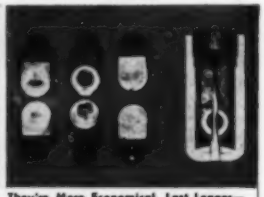
Ball bearing stem-to-wedge connection is safe, sure, long-lasting . . . means even distribution of load, less friction. All components of these stem-to-wedge connections are hardened and ground stainless steel.



They Can Be Safely Repacked Under Pressure—all alloy parts are 11½ to 13½% chromium stainless steel, hardened and ground, assuring positive cut-off. Back seating is also stainless-to-stainless.



They Have Permanent, Dependable Tightness—heavy force is applied to both end components when the valve is being made. The stellite seats are thereby pressed firmly against both sides of the wedge.



They're More Economical, Last Longer—the wedges shown operated a total of 41,872 times, against the downstream side in the valve body, opened to atmosphere and closed at 600# steam, superheated to 850°F. *No galling occurred!*

See Your Hancock Valve Distributor For Prompt, Efficient Service!

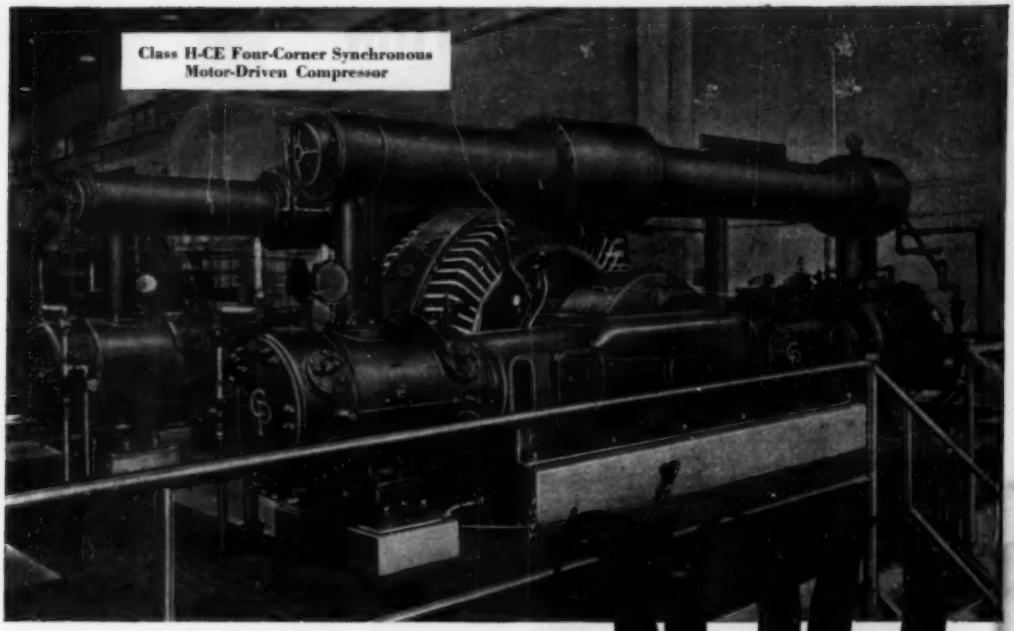
HANCOCK *Valves*

A PRODUCT OF

MANNING, MAXWELL & MOORE, INC.

WATERTOWN 72, MASSACHUSETTS

Makers of 'Hancock' Valves, 'Ashcroft' Gauges, 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load-Lifter' Hoists and other lifting specialties.



Class H-CE Four-Corner Synchronous Motor-Driven Compressor

Duplex synchronous motor-driven Compressors in sizes from 500

to 12,000 *c.f.m.*

piston displacement at 100 lbs. pressure

These compressors have anti-friction roller bearings throughout: spherical roller main and crankpin bearings, and heavy-duty needle bearings at the crosshead pins.

The use of roller bearings in the running gear eliminates all danger of misadjustment in maintenance. Roller crankpin bearings permit the use of solid-end connecting rods, the strongest and safest type.

a complete line

CP Compressors range from 7½ to 2000 h.p. in electric and steam-driven types, pressures to 5000 lbs.; vertical and horizontal models; CP Vacuum Pumps from 7½ to 1000 h.p.

Write for Bulletin 726

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

KAYLO HEAT INSULATION

...Easy to Handle and Apply

Kaylo Heat Insulation is easy to handle and apply—in all sizes, shapes and thicknesses—because of its high structural strength and light weight. This remarkable combination of high strength and light weight makes possible speedier application. It provides for units of greater size which permit larger surfaces to be covered faster. With these combined features, Kaylo Heat Insulation gives exceptional ease of handling—offers substantial savings in application costs.

Kaylo Heat Insulation is a hydrous calcium silicate (not glass) with a wide effective temperature range—up to 1200°F. It is inorganic and insoluble in water, incombustible and retains its dimensional stability in long service under severe conditions.

KAYLO PIPE INSULATION is made to Simplified Dimensional Standards of thicknesses and diameters. Coverings are sectional for tube and pipe sizes ¼" to 12"; tri-segmental up to 23"; quad-segmental up to 41"; K-segmental (18" wide segments) up to 72" in diameter.

KAYLO HEAT INSULATING BLOCK is made in all standard sizes and thicknesses from 1" to 6" for flat surfaces and for vessels larger than 60' in dinmeter; curved block 18" wide for smaller vessels.

SEND OUT CATALOG IN SWEET'S FILE

For complete details on Kaylo Heat Insulation, write Dept. N-180, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.

KAYLO® ...*first in calcium silicate*

...*pioneered by* OWENS ILLINOIS Glass Company

MAIN OFFICE: Toledo 1, Ohio — KAYLO SALES OFFICES: Atlanta · Boston · Buffalo · Chicago · Cincinnati · Cleveland · Detroit Houston · Minneapolis · New York · Oklahoma City · Philadelphia · Pittsburgh · St. Louis · Washington

DON'T BE SATISFIED WITH HALF-WAY MEASURES...

insist on Walseal® products and be certain

— the FACTORY INSERTED Ring insures FULL PENETRATION of the Silver Alloy . . . a perfect joint

Today, contractors . . . builders . . . architects are using brazed connections, in ever increasing numbers on their brass and copper pipe runs. However, they must be certain that the correct brazing alloy is used; that the joint has penetration of alloy up the shoulder of the fitting.

That's why more and more are turning to Silbraz® joints made with Walseal valves, fittings and flanges which assure the proper amount of alloy with no waste. They know that the finished joint not only will withstand hydrostatic pressure, but it will also withstand terrific impact and vibration – in fact, no correctly made Silbraz joint has ever been known to creep or pull apart under any pressure, shock, vibration or temperature which the pipe itself can withstand.

Furthermore, it is a relatively simple operation to make a Silbraz joint – no heavy scaffolding need be erected . . . just cut the pipe, flux, assemble, then braze, following the technique recommended by the Walworth Company. A silver brazing alloy – FACTORY INSERTED – in each port flows out when heated with the oxyacetylene torch, making a joint that is stronger than the pipe itself . . . a one-hand operation, with the mechanic out of the path of the deflected heat – at all times.

For full information about Silbraz joints made with Walseal products, write for Circular A-1.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

HIEROGLYPHICS · · · *with a modern meaning*

The workman of ancient Egypt knew the symbols of his trade. They helped him fashion stone and metal, wood and cloth, into the goods and structures which best served his era. . . . The needs of our modern industrial civilization are different. Visitors to Sun Ship's mighty shops see in the making the intricate steel fabric of petroleum refineries and chemical plants . . . massive bubble towers, pressure vessels, condensers, cracking cases, and a vast array of special machinery and equipment for many industries.

But even a visitor from the days of Egypt's Pharaohs would recognize two familiar facts — that strange modern "hieroglyphics" guide precise assembly of today's steel behemoths . . . and that Sun Ship workers are masters in their knowledge of the symbols and crafts of their trades. . . . The many modern industries served by Sun know these facts, too.

Illustration at top, reproduced from "The History of All Nations," shows ancient Egyptian shipbuilding as depicted on the tomb of Ti, at Sakkara. In contrast is the 55' regenerator being built by Sun.

Sun

SHIPBUILDING & DRY DOCK COMPANY

SINCE 1916

ON THE DELAWARE · CHESTER, PA.

25 BROADWAY · NEW YORK CITY

SLEEVOIL

—the super-quality fan bearing for mechanized draft installations!

● Hundreds of generating plants in America run on Dodge Sleevoil Bearings. These famous bearings combine quietness, long life and dependability to a degree unique in the bearing field. They offer engineers of costly power plants a priceless safeguard for their equipment.

Sleevoil Bearings are a Dodge development—created especially to meet the exacting requirements of fan and blower service. They are ideal bearings for important installations calling for induced or forced draft. Designed in cooperation with engineers of leading fan and blower manufacturers, they have a long record of dependable performance in critical service.

Dodge Sleevoil Pillow Blocks are normally available from stock—in both plain and water-cooled types, in shaft sizes from 1-7/16" to 8". Write us for information.

DODGE MANUFACTURING CORPORATION
200 Union Street, Mishawaka, Indiana

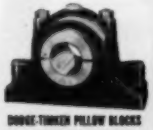
DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on *modern* power transmission machinery for *modern* installations. Look for his name under "Power Transmission Equipment" in your local classified phone book.

FIRST IN POWER TRANSMISSION MACHINERY!

SEALED-LIFE V-BELTS; TAPER-LOCK SHEAVES

TORQUE-ARM SPEED REDUCERS



DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

POWELL *has every kind of valve* YOU *need for handling* CORROSIVE MEDIA

In addition to a complete line in bronze, iron and steel, Powell can supply valves made in the greatest variety of corrosion-resisting metals and alloys ever used in making flow control equipment.

Fig. 1851 S. S.—Large size 150-pound Stainless Steel flanged end Swing Check Valve. Body-cap nuts and bolts are in Stainless Steel. These valves conform to latest standards. Available in various other corrosion-resisting metals and alloys.

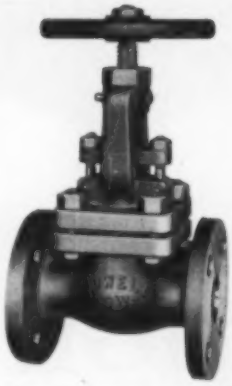


Fig. 2475—150-pound O. S. & Y. Globe Valve with flanged ends. Stem is threaded and guided through a bushing screwed into upper yoke. Plug type disc and seat can be easily reground, if necessary. Bolts and nuts are in Stainless Steel. Compression lubricant fitting in upper yoke. These valves conform to all the latest standards. Available in a large selection of corrosion resisting metals and alloys. Also made with screwed ends.

Fig. 2403-G—Large size 150-pound Stainless Steel Gate Valve. Made in sizes 5" to 30", inclusive. Has flanged ends, bolted flanged bonnet, outside screw rising stem and yoke. Separable yoke-arms. Can be furnished with accurately guided interchangeable solid or split wedges. These valves conform to all the latest standards. Available in a large selection of corrosion-resisting metals and alloys.

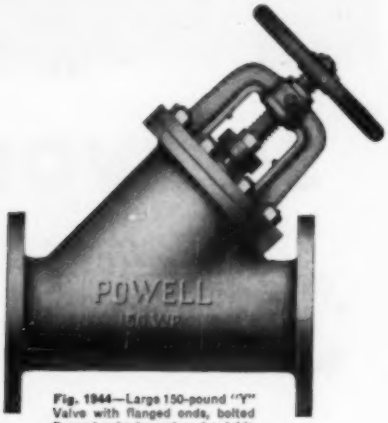


Fig. 1944—Large 150-pound "Y" Valve with flanged ends, bolted flanged yoke-bonnet and outside screw stem. Available in a wide variety of corrosion-resisting metals and alloys.

Fig. 1832—200-pound Stainless Steel Gate Valve. Screwed ends, screwed-in bonnet, inside screw rising stem. Available in many other corrosion-resisting metals and alloys. ➡

POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

The Home of

CUSTOM-MADE PRODUCTS

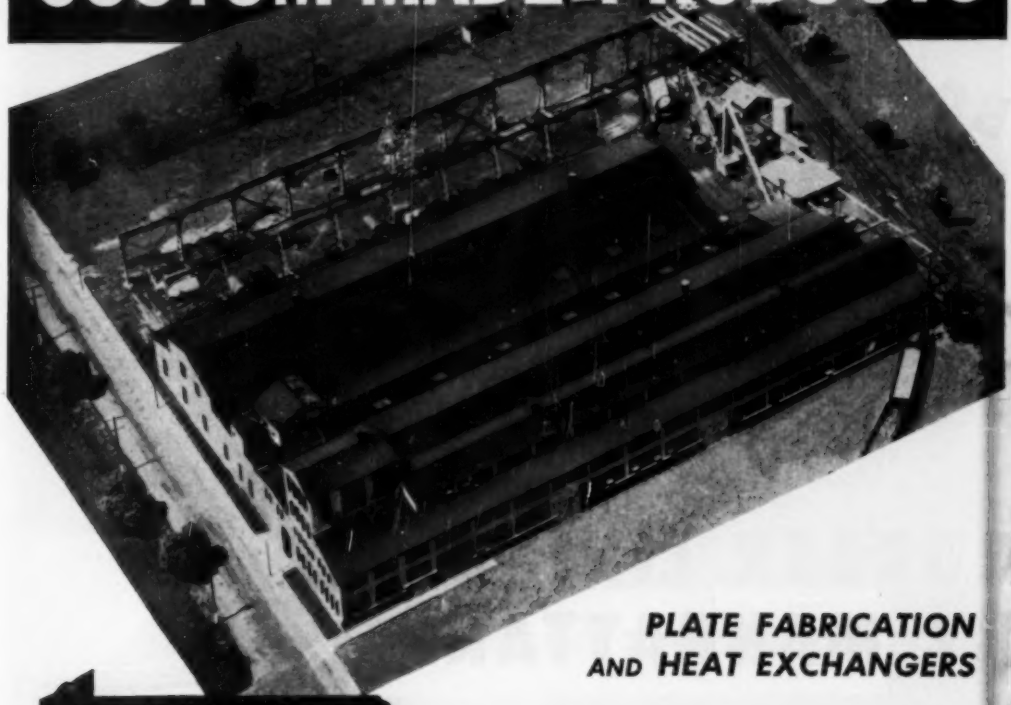
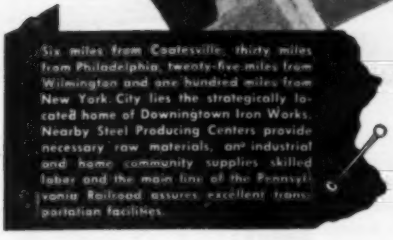


PLATE FABRICATION AND HEAT EXCHANGERS



Six miles from Coatesville, thirty miles from Philadelphia, twenty-five miles from Wilmington and one hundred miles from New York City lies the strategically located home of Downingtown Iron Works. Nearby Steel Producing Centers provide necessary raw materials, an industrial and home community supplies skilled labor and the main line of the Pennsylvania Railroad assures excellent transportation facilities.

Nearly 40 years ago the present management of DOWNINGTOWN IRON WORKS, INC. began to attain, and then maintain, the reputation of being *"among the finest in their field"*; i.e., Steel Plate Fabrication. We of DOWNINGTOWN, take justifiable pride in knowing that through these years we have never once sacrificed *quality* for price. The many developments in the variety of metals and methods of fabricating these metals have made our work most interesting, and we also like to feel that we have contributed, in a small way, to advancing the economy of our Country.

Our Heat Transfer Division, started in 1941, is maintained under the direction and supervision of men thoroughly trained and experienced in this line.

Heat Transfer Equipment of DOWNINGTOWN design is sold on a guaranteed performance basis or we will fabricate to customer's drawings. Useful literature gladly sent upon request on your Business Letterhead.

May we be of help to you? Remember, "Your needs are our Specialty!"

DOWNINGTOWN IRON WORKS, INC.
DOWNINGTOWN, PA.
STEEL & ALLOY PLATE FABRICATION
HEAT EXCHANGERS

NEW YORK OFFICE—30 CHURCH STREET

BONDED PROTECTION AGAINST CORROSION AND CONTAMINATION

RUBBER LINING BY MANHATTAN

"Bonded to Stay . . ."

That's Manhattan's claim to fame. Every Manhattan rubber lining is so securely bonded to metal—it can't physically be separated. This means permanent protection for equipment and process against loss by corrosion and contamination.

They expand and contract with the metal under temperature changes without cracking. They resist abrasion and rough handling and in plating equipment eliminate stray currents.

Before you invest be sure to investigate . . . the R/M rubber lining facilities near you. Consult an R/M rubber lining engineer. Write for Tank Bulletin MR557 and Pipe Lining Bulletin 6907.

RUBBER LINING PLANTS AT PASSAIC, N. J. AND NORTH CHARLESTON, S. C.

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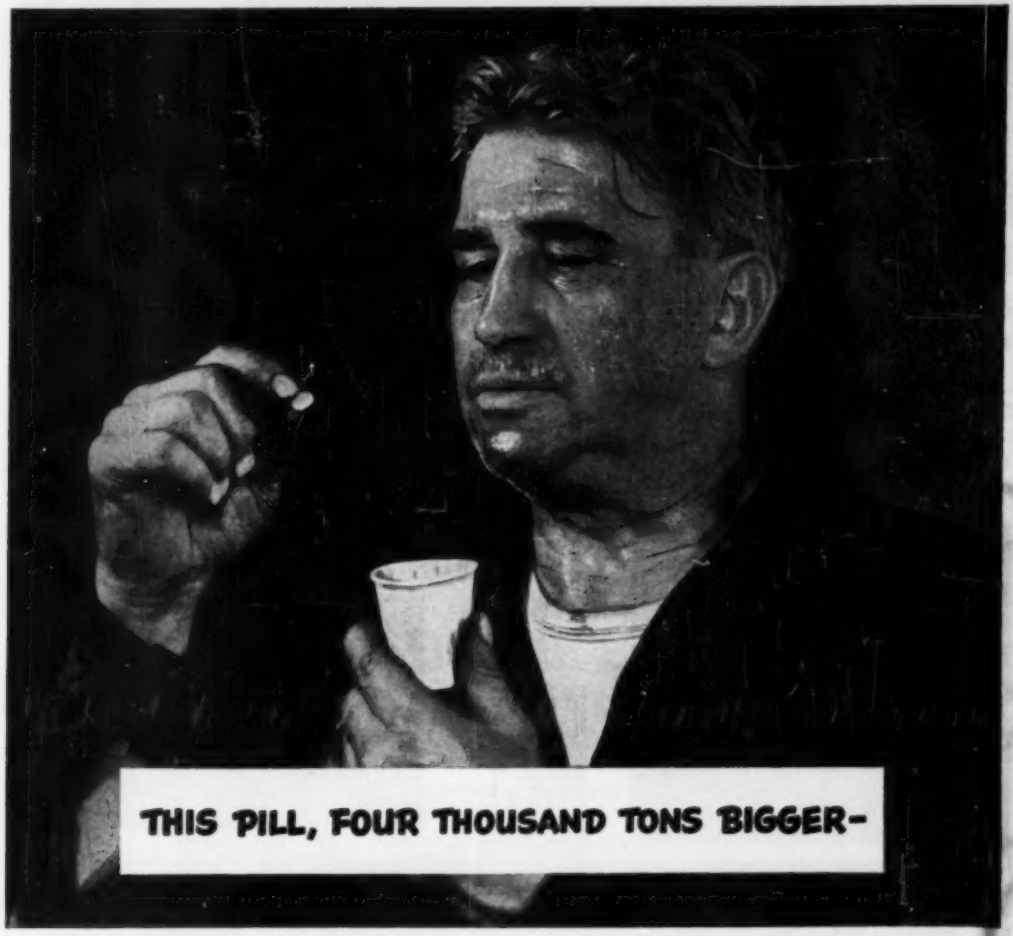
Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls



If the "hot men" of industry didn't take pills to replace the salt they sweat out, they'd collapse. Blood maintains a delicate acid-alkali balance by means of sodium and chlorine compounds. To an amazing degree, these same chemicals must be kept balanced in the life-stream of industry.

For example, there's now a chlorine shortage showing up in thousands of items: pulp and paper, insecticides, plastics, permanent antifreeze. DIAMOND ALKALI, as all the chemical industry, would like to increase chlorine production immediately. Equipment to produce just one ton of chlorine per day costs from $85,000 to $100,000, new plants take two years to build; nevertheless, the industry expects to be producing an additional 2000 tons a day during 1952.

This, however, is only the half of it. Every time a ton of chlorine is produced, a little over a ton of caustic soda is also produced. Two thousand tons more chlorine force industry to swallow 2000 tons more caustic, which means new users must be found. This constant balancing off of chemicals with their twins is at once the goad and the genius of chemistry.

DIAMOND ALKALI CHEMICALS

Chemicals you live by ... **DIAMOND ALKALI COMPANY** CLEVELAND, OHIO

SODA ASH • CAUSTIC SODA • CHLORINE & DERIVATIVES • BICARBONATE OF SODA • SILICATES • CALCIUM COMPOUNDS • CHROME COMPOUNDS • ALKALI SPECIALTIES

S W SPROUT WALDRON MUNCY, PA.

pointers to BETTER PROCESSING

EQUIPMENT INFORMATION FOR PROCESSING PLANTS

Modern "Mix" Room at General Aniline Works,

Rensselaer, N.Y.

—helps streamline the production of AZO DYES in country's oldest dye plant.

Sprout-Waldron Horizontal Batch Mixers receive the dye product after it comes from grinders. Here it is "standardized" by addition of shading colors and reducing agents to match dye type. After mixing operation is completed, final product batch is sent to the weigher and prepared for shipment.

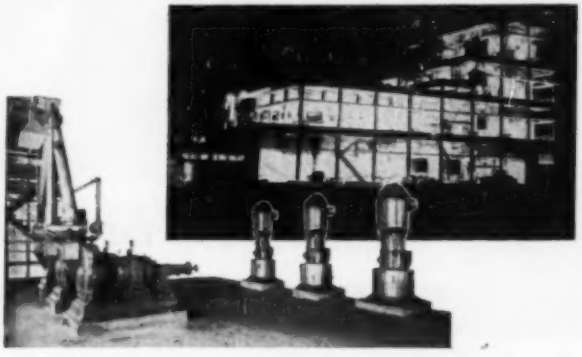
It's applications such as this that have established Sprout-Waldron as headquarters for mixing equipment. Consult with Sprout-Waldron on your requirements.

For further information about any of the equipment described, write to Sprout, Waldron & Co., Inc., 13 Waldron St., Muncy, Pa.

New Corn Products Plant Modernizes Starch and Sugar Production

The "Bluebonnet" plant at Corpus Christi, Tex., *made headlines*—not only because of its unique wall-less construction. Of even greater interest to the process industry are the much improved, continuous methods used to transform Milo Maize into starch and sugar. The engineers of Corn Products Refining Company broke with tradition—sought and found a *better way* to make starch!

Here, the old conventional stone-type buhr mill was replaced with modern-day *degerminating mills, disintegrators,* and *repulpers* . . . all specially equipped for starch processing.



At Corpus Christi, six Sprout-Waldron 36" single disc degerminating mills handle the full plant load of incoming grain, freeing the germ from the kernel without crushing it. After separation, three disintegrators and two S-W36" double disc repulpers take over and together do a job that formerly required six buhr mills, moisture expellers, and a three-stage coarse fiber washing station to get the same results.

Engineers of the "Bluebonnet" plant point out that the use of Sprout-Waldron repulpers, in combination with disintegrators, improves the recovery of starch, decreases maintenance costs, and requires considerably less floor space than previous methods.

Why not bring your size reduction problems to Sprout-Waldron? Our broad experience may be helpful to you, too!

Sprout-Waldron

Manufacturing Engineers

SINCE 1866

MUNCY • PENNSYLVANIA

LOOK TO SPROUT-WALDRON for BETTER PROCESSING EQUIPMENT

175-A

IT MUST BE *Continuous!*

THE SMOOTH FOLLOW-THROUGH OF A PITCHING STAR

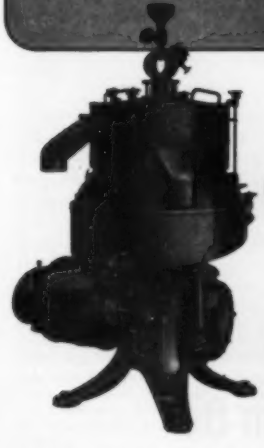
AND YOU CAN INCREASE PRODUCTION WITH CONTINUOUS SEPARATION THE DE LAVAL CENTRIFUGAL WAY!

So must processing be continuous if it is to be truly economical and fast these days. De Laval machines make most effective use of centrifugal force to speed up production by getting rid of unnecessary interruptions. Hours that once were required for settling or other inefficient methods of separation or clarification can now be cut to minutes or even seconds with De Laval centrifuges.

De Laval centrifugal machines are especially adapted to three classes of service—

1. The continuous separation of two liquids
2. The continuous clarification of one or two liquids
3. The continuous separation of two liquids plus the continuous removal of solids from one or both

Would any of these applications of centrifugal force speed up *your* process?



De Laval

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

CONTINUOUS SEPARATION AND CLARIFICATION WITH CENTRIFUGALS

SINCLAIR RESEARCH LABORATORIES—nine buildings containing the most modern testing equipment known—have contributed many of today's most important developments in the field of petroleum products, production and refining. Under the Sinclair Plan, the available capacity of these great laboratories is being turned over to work on the promising ideas of inventors everywhere.

An Open Door to Inventive Americans Who Need Laboratory Facilities

The SINCLAIR PLAN will open up the Company's great laboratories to every American who has an idea for a better petroleum product

A ROAD BLOCK stands in the path of American inventiveness today—it is the need for large and expensive laboratory facilities in developing and proving out new ideas.

This was no obstacle in our earlier days. Eli Whitney built his cotton gin with homemade tools in a barnyard. In contrast, the recent development of nylon took ten years of research time and 70 millions of dollars.

In short, the man with a new idea today bumps up against our complex technology and often finds that he is at a loss to prove out his invention without the help of great laboratories and an army of specialists. And how can the individual get the use of such facilities?

To break down this road block to outside invention within the petroleum field, we offer the Sinclair Plan.

The Sinclair Research Laboratories at Harvey, Illinois, have nine modern buildings equipped to handle every phase of petroleum research.

If you have an idea for a better petroleum product or for a new application of a petroleum product, you are invited to submit it to the Sinclair Research Laboratories, with the provision that each idea must first be protected, in your own interest, by a patent application or a patent.

If the directors of the laboratories select your idea for development, they will make, in most cases, a very simple deal with you: In return for the laboratories' investment of time, facilities, money and personnel, Sinclair will receive the privilege of using the idea free from royalties. This in no way hinders the inventor from selling his idea to other companies or from making any kind of arrangements he wishes without further reference to Sinclair.

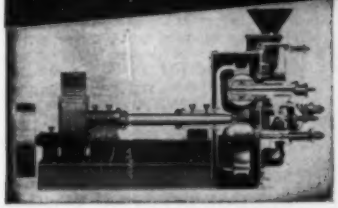
How to Participate

Instructions on how and where to submit ideas under the Sinclair Plan are contained in a complete Inventor's Booklet that is available on request. Write to the office of the Executive Vice-President, Sinclair Research Laboratories, Inc., 630 Fifth Avenue, New York 20, N. Y. for your copy of this booklet.

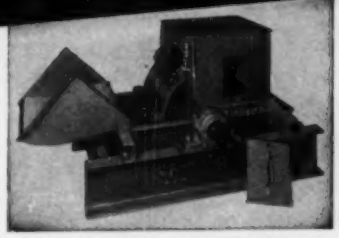
IMPORTANT: *Please do not send in any ideas until you have sent for and received the booklet of instructions.*

SINCLAIR—A Great Name in Oil

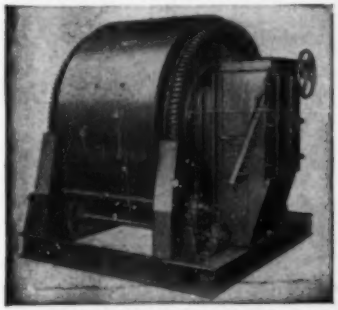
Step-up Production Lower Preparation Costs with STURTEVANT EQUIPMENT



RING ROLL MILL — for medium and fine reduction of hard or soft materials (10 to 200 mesh). Open-door accessibility for easy cleaning. Available in many sizes and capacities.

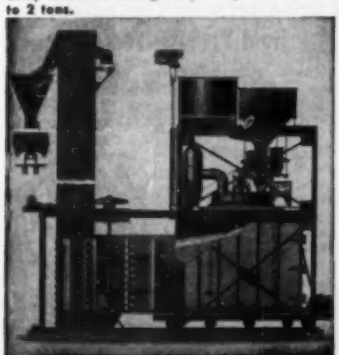


TAILINGS ROTARY PULVERIZER — increases output of fertilizer tailings . . . will not clog . . . leaves no daily accumulation of unground pellets. Capacities up to 25 tons per hour.



DRY BATCH MIXERS — 4-way mixing action mixes two or more ingredients into an inseparable, homogeneous mass. Open door accessibility makes cleaning easy. Capacities ¼ ton to 2 tons.

MOTO-VIBRO SCREENS — screen everything screenable. Open and closed models with or without feeders. Many types and sizes . . . screens from ½" to 60 mesh.



DEN AND EXCAVATOR — speeds processing of superphosphates. Easily operated by two men . . . produces 16 to 40 tons per batch and up to 480 tons per day of superior fertilizer free from lumps.

AIR SEPARATOR — for finest separation of materials. Capacities from ¼ ton to 50 tons per hour in fineness of 40 to 325 mesh and finer. Increases production of fines, cuts power consumption costs.

Sturtevant Processing Equipment . . . Grinders, mixers, separators, screens, etc. . . . can help you *reduce* today's high manufacturing costs by increasing both machine and operator output, lowering production costs, assuring high quality products.

Records in all types of industries — chemical, plastics, ceramics, cement, food, construction — prove that this equipment works dependably day in, day out with little, if any, maintenance.

Used individually or linked together in proper sequence, they do the job faster and easier than other types . . . handle a larger variety of work.

It will pay you to investigate Sturtevant Processing Equipment for your plant. There is a size and type of machine that will meet your requirements. Write for information.

STURTEVANT MILL COMPANY

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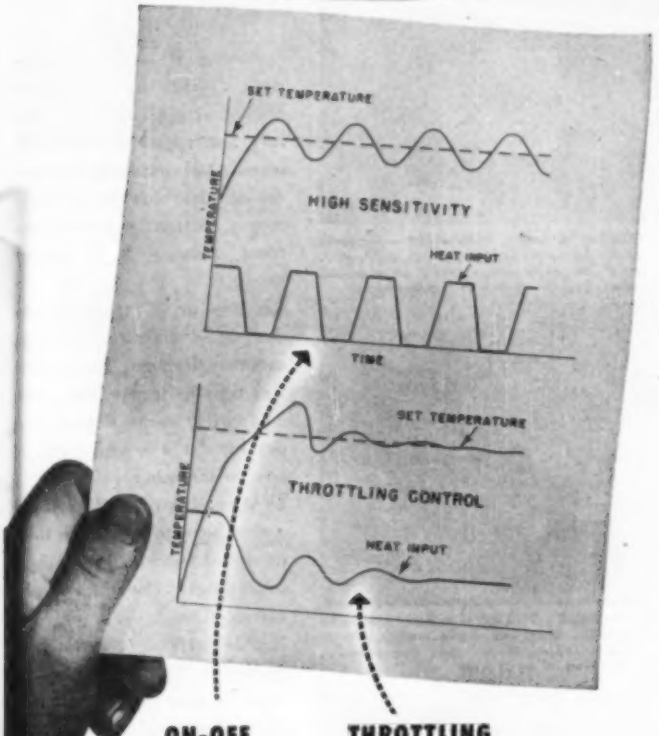
CRUSHERS • GRINDERS • SEPARATORS
CONVEYORS • MECHANICAL DENS
and EXCAVATORS • ELEVATORS
MIXERS

FOR *Consistent* CONTROL

Choose Characteristics to

FIT YOUR CONDITIONS



ON-OFF
The simplest control, excellent for ordinary needs. Fastest heating to set temperature.

THROTTLING
Closely holds set temperature, balances continuous heat input against heat losses.

Furnaces heated by oil, gas or electricity can be accurately controlled with TAGliabue Pneumatic Controllers. On-off types give fastest heating; throttling types accurately balance heat input against losses to prevent overshooting or hunting. Both utilize an 18 p.s.i. air supply to operate diaphragm valves or power relays. Companion models control pressures along the same principles. Available as Indicating Controllers or as Recorder-Controllers. Write today for technical literature.

TAGLIABUE INSTRUMENTS DIVISION
WESTON ELECTRICAL INSTRUMENT CORPORATION
614 Frelinghuysen Avenue, Newark 5, New Jersey

Dielectric Moisture Meter Checks Various Materials

Moisture content of finely powdered, relatively dry, or coarse and oily materials is determined in less than two minutes with the versatile Model 8007 Dielectric Moisture Meter developed by TAGliabue Instruments Div., Dept. 67, Weston Electrical Instrument Corp., Newark 5, N. J. Operating over an extremely wide range, this meter functions without damaging the sample.

To use, a weighed sample is placed in a cell inserted in the instrument. The meter shows the material's capacitance, which simple tables convert into percent moisture. Chemicals, dehydrated foods, soaps, flours, seeds, plastic molding powders, iron ore, coal, cheese, coffee, corn, grain, dried leaf, flue dust, starch, yeast and cottonseed typify materials tested.

Weston Metal Thermometers Combine Precision, Stamina

Accurate, reliable temperature indication is given by the all-metal Thermometers manufactured by Weston Electrical Instrument Corp., Newark 5, N. J. These sturdy instruments are designed for utmost legibility and are constructed for use under severe operating conditions.

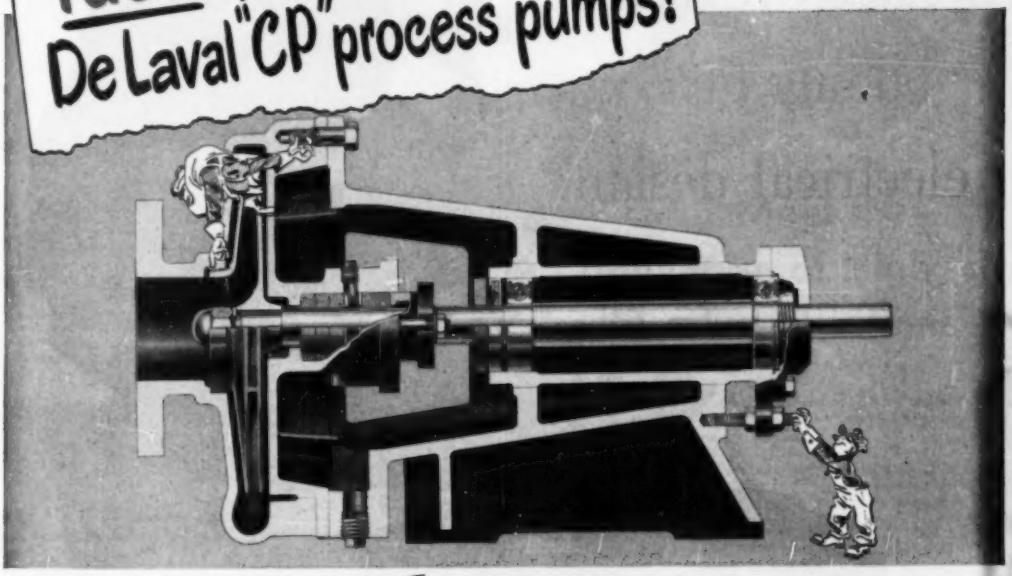
Weston All-Metal Thermometers can be supplied with the stem projecting from the back or from the bottom, top or side at any angle. Stem lengths from 2½" to 24" are standard; stems as long as 72" are available. A 3" dia. head provides a scale 6" long. Temperatures as low as —100°F. or as high as 1000°F. can be indicated. The "Max-Min" type records highest or lowest temperature since resetting. Contact making type closes an electrical circuit at an easily set value. Special models are also available.

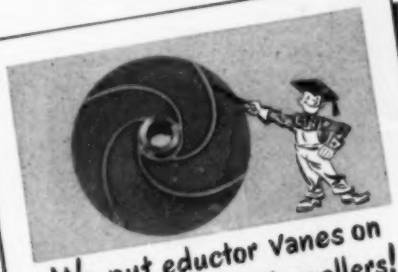
Self-Operating Controllers Hold Precise Temperatures

Temperatures between the limits of 20 and 300°F. are accurately maintained by the line of Self-Operating Controllers manufactured by TAGliabue Instruments Div., Dept. 67, Weston Electrical Instrument Corp., Newark 5, N. J. These controllers are entirely self-contained, requiring no connection to any air or electrical power supply.

Available in styles for use on steam, hot water or refrigerant lines, TAG Self-Operating Controllers continuously adjust the supply of heating or cooling medium to maintain constant temperature despite changing thermal conditions. Typical applications include water heaters, tanks, retorts, washers, driers and pasteurizers.

Facts you should know about De Laval "CP" process pumps!





We put eductor vanes on the back of open impellers!

Why? Because the eductor vanes develop higher pressures than the pumping vanes. This reduces end thrust, relieves stuffing box pressure, keeps the back of the impeller clean and prevents binding . . . all important points that insure better operation and less maintenance.

NOW! You can adjust a pump for wear without opening it up!

How? It's easy if you have a De Laval CP pump. The secret is in the tapered wearing ring. This means you don't have to replace the wearing ring to restore the pump to its original efficiency. All you do is turn this external adjusting screw. This moves the entire rotor and impeller forward and permits you to adjust for proper clearance between the case and wearing ring . . . *it's as simple as that.*

DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

50th DE LAVAL Anniversary

CPP-8

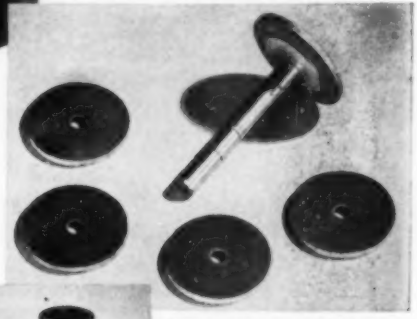
What's U.S. Rubber doing for electrical design?

Transformer handle made of Enrup for a large manufacturer of electrical equipment. Enrup was selected because its electrical properties can be maintained under very adverse conditions, and because it has great toughness, impact strength, and resistance to other solvents. Enrup has been so successful that the manufacturer intends to use it for other phases of transformer design and construction.

The horizons of electrical design are being widened by U.S. Rubber's new thermosetting plastic, Enrup. The transformer handle shown here has greater strength and electrical properties because it is made of Enrup.

This remarkably versatile substance can be punched, sanded, sawed, nailed, bolted, molded or machined. Enrup can be made into almost any shape or form, simple or complex. It may be exactly what you have been looking for to make your product stronger, more efficient, less expensive.

Enrup is fabricated and molded entirely by U.S. Rubber engineers. They will gladly discuss your particular problems. Write to address below.



Pump valve seat made of Enrup because Enrup resists swelling or deterioration caused by gasoline, and because it resists compression set or deformation over a wide range of temperature conditions.

This printing roll-end bearing demonstrates Enrup's high adaptability to precision molding techniques. It has high dimensional stability and resistance to corrosion caused by photographic solutions.

PRODUCT OF

U.S. RUBBER
SERVING THROUGH SCIENCE

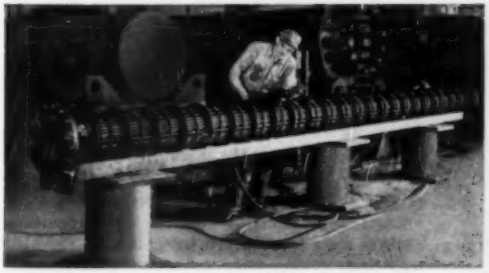
UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

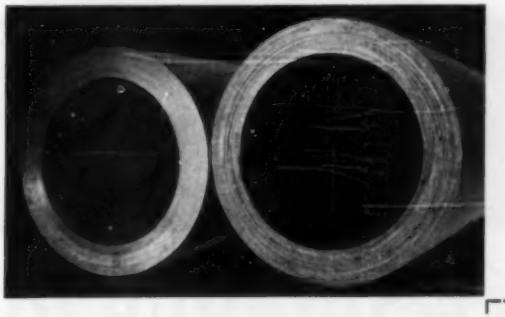
A.O.Smith Multi-Layer Heat Exchangers

MULTI-LAYER HeatExchanger for an ammonia plant. The shell, designed for 5150 psi working pressure, is 23 inches and 15¾ inches in diameter with wall thickness of 4¼ inches and 3 inches, respectively.

Meet the Challenge of High Pressure Specifications



Heat Exchanger tube bundle for the above is designed to take advantage of low differential operating conditions within an exchanger designed for 5150 psi chemical process.



Remarkable flexibility of design and manufacture makes A. O. Smith MULTI-LAYER Heat Exchangers adaptable to a wide range of high-pressure services.

MULTI-LAYER Heat Exchanger shells are built up from concentric layers of relatively thin steel plate progressively wrapped, tightened and welded together around an inner pressure-tight cylinder.

Wrapping tension and weld shrinkage develop desirable compression in the inner layers of the shell during manufacture. This results in more equalized loading of all portions of the heat exchanger wall under working pressure. Thus, the full calculated strength of the steel is more completely utilized.

Where corrosion is a problem, only the inner shell need be made of corrosion-resistant materials. The load-bearing portion of the vessel wall—since it is not in contact with corrodents—can be manufactured of more economical and readily weldable steel plate.

This feature, alone, frequently effects substantial savings over the cost of solid alloy construction and is especially advantageous during the current restrictions on use of certain alloy materials.

Call upon A. O. Smith for assistance on your heat exchanger problems. Write the nearest office or use the handy coupon.

End view of a MULTI-LAYER Heat Exchanger shell course showing how the wall is built up from concentric layers of thin steel plate. To the right: end view after wrapping is completed. To the left: end has been machined and scarfed, ready for welding to the next shell course or end closure.

A.O.Smith

VESSELS • HEAT EXCHANGERS

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Houston 2 • Los Angeles 22 • Midland 5, Texas • New Orleans
New York 17 • Philadelphia 3 • Pittsburgh 19 • San Francisco 4
Seattle 1 • Tulsa 3 • Washington 6, D.C.
International Division: Box 2023, Milwaukee 1

A. O. Smith Corporation
Dept. CE-651, Milwaukee 1, Wis.

Without obligation, send me bulletins and information on your MULTI-LAYER Heat Exchangers and their construction features.

Name_____

Address_____

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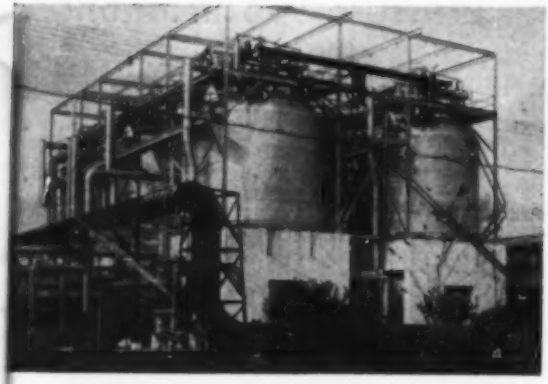
City_____

SULPHUR

*Interesting Facts Concerning This Basic Raw Material from the Gulf Coast Region

*SUPERHEATED WATER . . .



Mining operations are most successfully carried out if the water pumped into the sulphur deposit is heated under pressure to a temperature of about 320° F. For large scale mining, enormous quantities of water are required, so, a primary requisite is an adequate supply of suitable water and an efficient power plant in which to heat it.

To insure a continuous supply of water at Newgulf, it is the practice to use river water pumped in time of flood or full flow and stored in large reservoirs. This supply is supplemented, when necessary, with well water. Water so obtained is seldom suitable for use in boilers or mine water heaters without being treated first because of natural salts in solution. Softening by chemical treatment is necessary to prevent deposition of scale on boiler tubes and hot water lines.

Loading operations at our Newgulf, Texas' mine

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Mines: Newgulf and Moss Bluff, Texas

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WORM GEAR DRIVES

Smooth, trouble-free operation and better power transmission are assured with Foote Bros. Hygrade Heavy-Duty Worm Gear Drives.

New developments in manufacturing provide precision generated gears which give improved performance and greater load-carrying capacity.

Advanced engineering, improved design, modern heat treatment and manufacture — all mean higher quality — greater dependability.

Hygrade Drives with ratios up to 4108 to 1, or higher when required, are available in horizontal, vertical and Hytop types. The Hytop design permits long, unsupported vertical output shaft extensions.

Mail the coupon below for bulletin giving complete information on Foote Bros. Hygrade Enclosed Worm Gear Drives.

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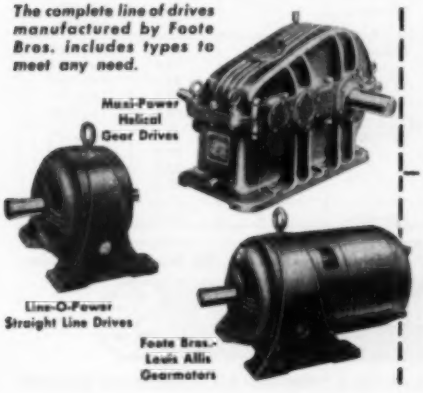
The complete line of drives manufactured by Foote Bros. includes types to meet any need.



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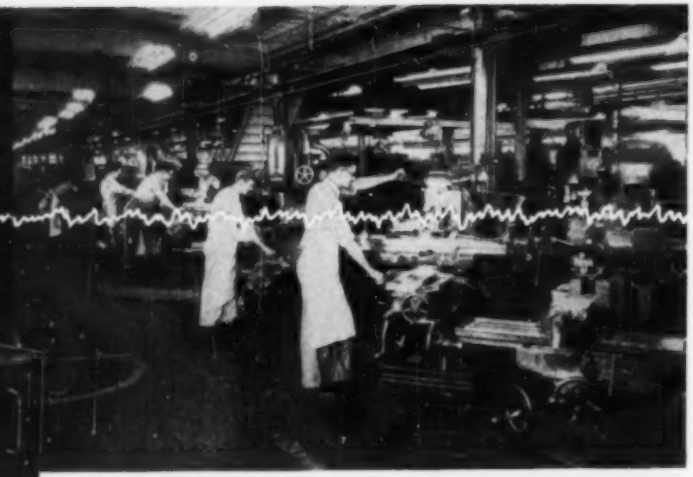
HAVE YOU CHECKED YOUR PLANT PULSE LATELY



ELECTRO MECHANICAL TYPE EM4115 SHOWN

AUTOMATIC VOLTAGE REGULATION WILL HELP CURE OPERATING DEFICIENCIES

STABILINE *Automatic* EM VOLTAGE REGULATORS

feature LOW COST and EFFICIENT OPERATION IMPROVE PERFORMANCE and REDUCE COSTS

Increased demands on today's electrical manufacturing equipment call for maximum performance, extended parts life and reduced maintenance. When incoming line voltages fluctuate, manufacturing inefficiencies and rising costs are bound to occur. To maintain constant voltage to equipment regardless of variations in line voltage or load current, install a STABILINE Automatic Voltage Regulator type EM (ELECTRO MECHANICAL).

Simple and easy to install, a STABILINE type EM features high efficiency — zero waveform distortion — complete insensitivity to magnitude and power factor of load — adjustable output voltage and no critical adjustments.

	Nom. Output Voltage	Input Voltage Range	Output Voltage Range	Output Current (Amperes)	Output KVA	Type
Single Phase	115	95-135	110-120	17.5	2.0	EM4102
				52.0	6.0	EM4106
				130.0	15.0	EM4115
	230	195-255	220-240	32.5	7.5	EM4207
				120.0	27.5	EM4228
	460	400-520	420-460	15.0	6.6	EM4407
				40.0	17.6	EM4418
Three Phase	230	195-255	220-240	25.0	10.0	EM6210Y
				38.0	15.0	EM6215Y
				50.0	20.0	EM6220Y
				113.0	45.0	EM6245Y
				175.0	70.0	EM6270D
	460	400-520	420-460	16.0	12.5	EM6412Y
				22.0	17.5	EM6417Y
				33.0	25.0	EM6425Y
				66.0	50.0	EM6450Y
				100.0	75.0	EM6475Y
		420-500	420-460	131.0	100.0	EM64100Y

There's a STABILINE type EM to meet your need. Standard types are listed in the rating chart. For special requirements consult **The Superior Electric Company, 206 Church St., Bristol, Conn.**

STABILINE type IE (INSTANTANEOUS ELECTRONIC), a completely electronic unit with no moving parts, is available in ratings from 0.25 to 5.0 KVA.

Learn more about STABILINES type IE and EM. Write today for Bulletin S351 complete with application data, ratings, dimensions and circuit diagrams.

THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT

POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS

"Dependable" is the word for Wyandotte

The men who buy soda ash know Wyandotte . . . know Wyandotte is dependable. Vast company-owned resources of coal, salt and limestone make Wyandotte a source of supply you can depend on. And manufacturing controls make Wyandotte Soda Ash a product you can depend on. For on-time deliveries, for a uniform product, you can depend on Wyandotte.

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA
CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE
HYDROGEN • DRY ICE • SYNTHETIC DETERGENTS • GLYCOLS
CARBOSE (Sodium CMC) • ETHYLENE DICHLORIDE • PROPYLENE
DICHLORIDE • AROMATIC SULFONIC ACID DERIVATIVES
OTHER ORGANIC AND INORGANIC CHEMICALS

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This Bulletin HAS MANY OF THE ANSWERS TO YOUR QUESTIONS ON Air Cleaning

It Covers:

- AIR POLLUTION CONTROL
- BUFFALO "DC" STATIC WASHERS
- BUFFALO HYDRO VOLUTE SCRUBBERS
- BUFFALO WET GLASS CELL AIR WASHERS
- BUFFALO CUPOLA WASHERS
- BUFFALO GAS SCRUBBERS
- BUFFALO HYDRAULIC SCRUBBING TOWERS

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"Buffalo"

KNOW-HOW IS AT YOUR SERVICE!

Fifty years ago, "Buffalo" Air Washers were solving dust problems for industry. Today our vast background of experience in dust and fume control is at your disposal. Whether your problem is the elimination of a nuisance or air cleaning for process control, "Buffalo" has the equipment and the know-how to help you solve it. Call on us for recommendations.

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

501 BROADWAY, BUFFALO, N. Y.

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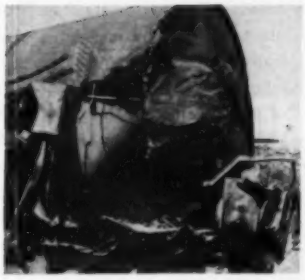
VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

Re-orders
speak louder than words

Take the case of Warren Petroleum Corp.

Warren started using A.C.F. Tank Cars back in 1929. The first order was for 100 cars. For 6 years, the orders stayed small: 10 cars...20 cars...15 cars. Then, as these A.C.F. Tank Cars began to set impressive service records, the orders swelled: 100 cars ...357 cars...*600 cars!* At this writing, Warren has backed A.C.F. Tank Car quality with orders for *over 2,500 cars!*

All-Welded Cars Now Standard



An example of what A.C.F. All-Welded construction can mean to a shipper. This fully-loaded car received a severe bump on the circumferential end seam. Although the seam was deeply dented, the shell remained intact!

Over 1,000 of Warren Petroleum's tank cars have been of the *all-welded, X-Ray-tested* class. Operating records show these A.C.F. cars safer to run...less costly to maintain. Read about the amazing assembly-line construction techniques that make these savings possible. Write for information: American Car and Foundry Company, 30 Church Street, New York, N.Y. Other Sales Offices: Chicago • St. Louis • Cleveland Washington • Philadelphia • San Francisco

A.C.F.

ALL-WELDED **TANK CARS**

for Safe Delivery—

Jefferson

... hallmark of high quality chemicals from hydrocarbon sources

National defense requirements have created emergency demands for Jefferson chemicals. Although our facilities are being expanded as rapidly as possible to cope with these requirements, many of our chemicals are currently in short supply. We nevertheless welcome your inquiries and will make every effort to serve you.

Jefferson Ethylene Dichloride

Solvent, extractant, intermediate, Jefferson ethylene dichloride has already proved its worth in every part of the chemical processing industry from edible oils to anti-knock fluid. For further details, write to Department G.

Jefferson Chemical Company, Inc.

711 FIFTH AVENUE, NEW YORK 22, N. Y.

ESSENTIAL CHEMICALS FROM HYDROCARBON SOURCES

ETHYLENE OXIDE
DIETHYLENE GLYCOL
ETHYLENE DICHLORIDE
ETHYLENE GLYCOL

Briefs

From recent literature

Paint remover compositions consisting essentially of a chlorinated solvent, such as ethylene dichloride, 0.1-50% by weight of a mixture of approximately equal parts of 90% concentration formic acid and 100% concentration acetic acid, and 0.01-6% by weight of water have been found to have very high stripping power.

Rubberlike materials having many of the properties of natural rubber are reported from the reaction of ethylene dichloride with a solution or dispersion of sulfur in an alkali metal monosulfide solution. This reaction must take place in a closed reaction vessel and the time and temperature kept as low as possible to produce a satisfactory product.

Alkaloidals can be extracted from plant material by use of concentrated aqueous ammonia and ethylene dichloride. For each kilogram of ground plant material, 400 ml. of 30% aqueous ammonia and 4,000 ml. of ethylene dichloride is preferred. It is convenient to operate between room temperature and the boiling point of ethylene dichloride and the extraction time must be determined experimentally for each plant material.

These developments are abstracted from recent publications or U. S. patents. They may suggest other applications of Jefferson Ethylene Dichloride in your products or processes.

Are you taking full advantage of

PYREX Brand "DOUBLE-TOUGH" GLASS PIPE?

There are more uses for PYREX brand "Double-Tough" glass pipe than you might think. For example, packed columns of PYREX brand pipe offer unique advantages for gas scrubbing and absorption, distillation and fractionation. Visibility permits constant check on condition of packing and product flow. And PYREX brand glass pipe is highly resistant to corrosion, physical and thermal shock.

This is but one application of this tough, practical piping. You'll find it the ideal solution to your problems of gas and liquid transfer in food and chemical processing, distillation, heat exchange and pilot plant work.

Your own men can install it. And its high heat resistance (up to 450°F.) "Double-Tough" strength and exceptional resistance to corrosion assure long service life. You can save thousands of dollars in installation and replacement costs.

Available Now, PYREX brand "Double-Tough" glass pipe is stocked by distributors the country over. It is supplied in 1" 2", 3", 4", and 6" I.D., including standard fittings. The coupon below will bring you a new catalog giving complete details.

MAIL IT TODAY!

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Massachusetts Bicknell Company Cambridge, Massachusetts	Fisher Scientific Company Montreal 3, Quebec, Canada
Fred S. Hickey, Inc. Chicago 44, Illinois	Scientific Supplies Seattle 4, Washington
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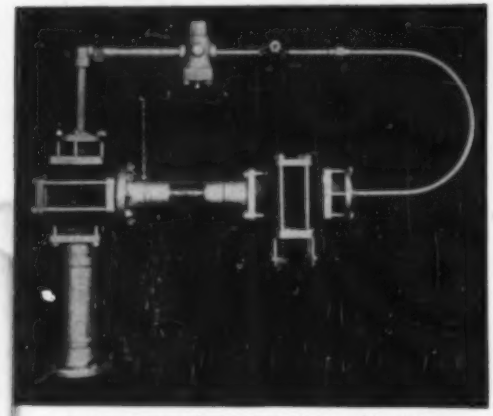
NOTES for Process Engineers

C. H. Wheeler OF PHILADELPHIA

COOLING TOWERS—VACUUM REFRIGERATION—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE REDUCTION MILLS—STEAM CONDENSERS—STEAM JET EJECTORS—MARINE CONDENSERS & EJECTORS—DECK MACHINERY



Two-stage non-condensing impervious graphite ejector

Send for catalog 1462. It contains helpful tables and tips on Steam Jet Vacuum problems. It also describes the complete line of C. H. Wheeler Tubejets. It will be mailed at no obligation to you.

STEAM JET EJECTORS
Made of IMPERVIOUS GRAPHITE For Handling CORROSIVE VAPORS

If your vacuum equipment is inefficient due to corrosion from acid fumes, this item holds an answer to your problems.

For highly corrosive acids such as sulphuric, hydrochloric, nitric, etc. C. H. Wheeler impervious graphite ejectors are recommended. The impervious graphite is enclosed in a steel or cast iron casing to prevent breakage. It is light in weight, non-porous, with low coefficient of thermal expansion and high resistance to thermal shock. Impervious graphite is most commonly recommended for the single and two-stage non-condensing ejectors.

C. H. Wheeler Ejectors can also be furnished of other materials such as acid resisting bronze, monel and stainless steel where the corrosive action of the vapors being handled does not require the use of impervious graphite construction.

"SELF-CLEANING" CONDENSERS by REVERSE FLOW featured in C. H. WHEELER Bulletin

The C. H. Wheeler Manufacturing Company's unique design of an integral reverse-flow steam condenser provides the most practical method yet devised for cleaning the tube sheet, and eliminates the need for expensive mechanical water straining apparatus. A recently issued bulletin tells how it works.

For C. H. WHEELER Literature
Attach this Handy Form to Your Company Letterhead

Interested in following literature

- ☐ Steam Jet Ejectors (catalog 1462)
- ☐ "Self-Cleaning" Reverse-Flow Steam Condensers

Your Name .....

Your Job .....

(Literature will be mailed to address shown on your company letterhead)

ANOTHER TOWER FOR SAN ANTONIO
13 Cell, 55,000 GPM Capacity to be Built by C. H. Wheeler for City Public Service Board, San Antonio, Texas. Gibbs & Hill, Engineers & Constructors

Following construction of two 7-cell Cooling Towers at the Leon Creek Power Station of San Antonio, Texas, C. H. Wheeler has been awarded the construction of a third and larger tower. The first towers were designed for 30,000 GPM. The new tower will handle 55,000 GPM to serve a 60,000 KW generator. It is a 13-cell induced-draft tower designed for 76.5° wet bulb, taking water at 105.5° inlet and cooling it to 90° outlet. Proposed construction is 39'8" x 364' x 29'. It will resist 30 lbs. per square inch wind pressure, or 100 mph hurricane force. Gibbs & Hill, New York are the engineers and constructors on the job.

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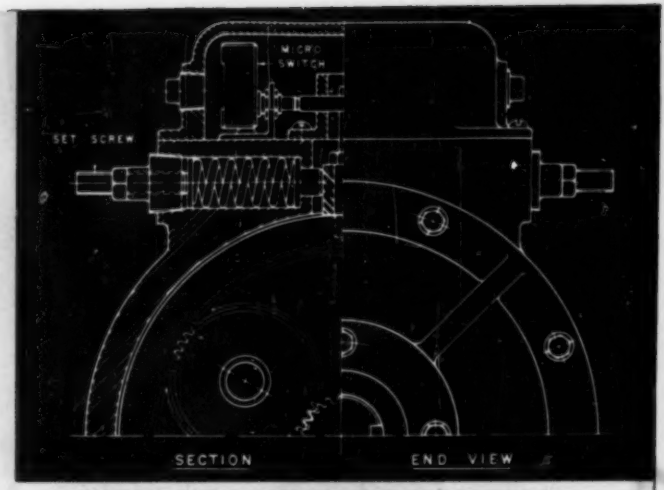
Positive Protection from OVERLOAD DAMAGE

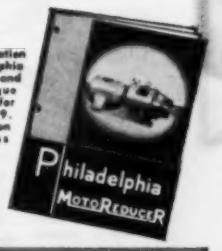


PHILADELPHIA PLANETORQUE MOTOREDUCER

CUTS OFF MOTOR CURRENT INSTANTLY AND AUTOMATICALLY

. . . when the load reaches a predetermined value, thus protecting both the driven machinery and the drive unit from overloads. This feature can be provided on any MotoReduceR . . . either vertical or horizontal types. On removal of the excessive load the PlaneTorque MotoReduceR may be started without resetting the switch. Incidentally, the PlaneTorque can be cut out during the starting period, by merely holding down the starting button; upon release PlaneTorque is again operative. The PlaneTorque is ideal for Stoker drives, Conveyors, Crushers, Mixers, Rolls, Pulverizers and a "hundred and one" other machines. MotoReduceRs are available in all required Horsepowers and Reduction Ratios. Efficiencies are as high as 97%.

For full information about Philadelphia MotoReduceRs and the PlaneTorque feature, send for Bulletin MR49. Please write on your Business Letterhead.



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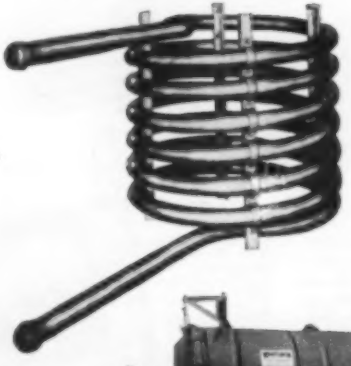
Whitlock facilities and technique offer you metal-working versatility that's unsurpassed. If it's of metal . . . and if the job requires rolling, forming, bending, or welding . . . your best bet is Whitlock! Our facilities include a complete weld shop; extensive plant for coiling and bending; machine shop—plus heat-treating, radiography, and testing equipment for virtually every need. Add to this our competent design and engineering section, and you have a truly *complete* source for all types of process equipment. Write today for Bulletin No. 945. The Whitlock Manufacturing Co., 94 South St., Hartford 10, Conn.



Straight tube—fixed tube sheet condenser with compensating shell expansion member. All aluminum except for steel channels and backing flanges. Aluminum welds by inert, gas-shielded arc method.

3" extra-heavy I.P.S. seamless copper pipe cylindrical coil. Full penetration welds using molded ceramic backing rings with inert, gas-shielded arc method.

97" diam. by 40' long vacuum chamber. Reinforced with 5" I-beams for vacuum service. Hinged door suspended from jib crane for easy product loading.

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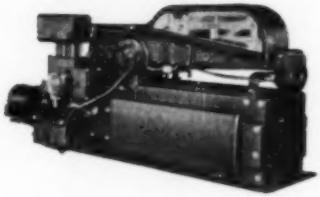
PRESSURE VESSELS • PIPING • PROCESS EQUIPMENT • FABRICATIONS

W&T MERCHEN WEIGH FEEDERS

Give Greater Product Uniformity



Weigh-blending of chemical ingredients — the only *accurate* way to blend—calls for precision equipment and "know-how".

W&T Merchen Weigh Feeders meet the first of these requirements with these features:

- Feed and weigh in *one* operation
- Handle ounces to hundreds of pounds per minute
- Manual or automatic control
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Your W&T Engineer brings you the "know-how" from his experience in designing and supervising hundreds of Merchen Weigh Feeder installations.

Write today or see your W&T Engineer.

M-15

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CHEMICALS in Quebec
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BENTONITE in Wyoming, South Dakota
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WELDCO Always Meets Your *Specifications*

TO GET TOP-QUALITY TUBING made to your individual needs, it's always good business to specify Weldco. For Weldco is produced by tubing specialists—men who have the equipment, facilities and experience to manufacture tubing to your exact specifications. Weldco is automatically machine-welded under pressure, properly formed, carefully finished, accurately sized and straightened, and rigidly checked.

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"Test Tubes" for Process Engineers

Results obtained via Blaw-Knox Pilot Plants determine at very small cost the equipment and technique essential to full-scale production. With Electro-Vapor heating and water cooling very little hook-up is required, and their versatile design facilitates frequent runs of varied formulas. From a description of the process involved, we can quickly quote standard or special equipment that will meet your requirements. Write for Bulletin 2273.

PROCESS EQUIPMENT DEPARTMENT

BLAW-KNOX

DIVISION OF BLAW-KNOX COMPANY

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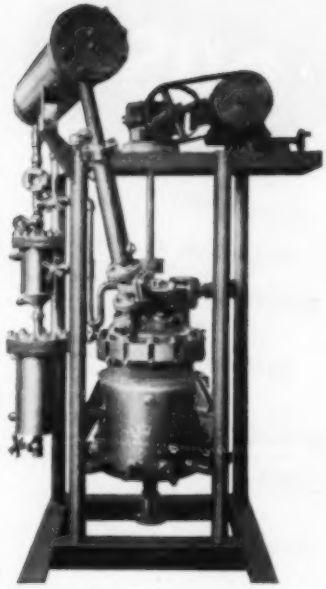

Typical arrangement for 15-gallon and 35-gallon Electro-Vapor pilot plants is illustrated. Similar units with capacities up to 100 gallons are rendering highly satisfactory service to our many customers.

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WATER BLENDERS

A 3-way mixing valve which provides any set temperature regardless of the incoming hot or cold water pressures and temperatures. Used for washrooms, process work and engine jacket cooling. Several types available; sizes ½" to 4". Cat. No. 800.

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Floatless
LEVEL CONTROL

for BOILERS, TANKS, EVAPORATORS, HEATERS, STANDPIPES, etc.

A simple solution to a troublesome problem

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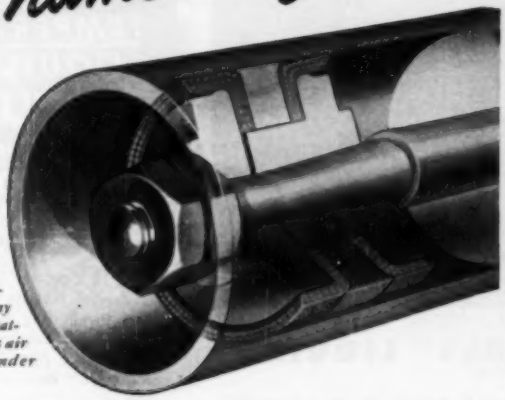
PRESSURE REDUCING VALVES • • PRESSURE CONTROLLERS
PUMP GOVERNORS • • • TEMPERATURE REGULATORS
SELF CLEANING STRAINERS • • LESLIE-TYFON WHISTLES

You name the fluid...



Phantom cutaway showing typical Pumcup-piston assembly—one of many types for all reciprocating pumps as well as air or hydraulic cylinder mechanisms.

Here's how to pump it at lower cost!

IN thousands of plants, Darcova Pumcups are solving the problem of diminishing pump efficiency, repacking, maintenance, down-time, lost production—the things that really eat up dollars in fluid-handling operations! Here's why . . .

1. Darcova composition Pumcups not only increase volumetric efficiency, but they *keep* it high with no appreciable fluid slippage for the entire life of the Pumcups.

2. And, because of their design, composition, and operating principle, Pumcups have *many times the life* of most other types of piston packing.

3. Based on years of application research, Pumcups come in standard and special compositions for exceptional stability in handling almost *any* fluid you can name. For example . . . strong acids and alkalies, food products and even the most troublesome petroleum derivatives.

Big savings? We'll gladly refer you to Pumcup users whose problems are similar to yours. *They'll* tell you! Meanwhile, send for a free bulletin containing helpful, more detailed information: Bulletin 4401 on Pumcups for reciprocating pumps; Bulletin 4502 on Pumcups for air and hydraulic mechanisms. Just write to . . .

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THE ORIGINAL COMPOSITION CUP

PUMCUPS

depend on CAMCO
rugged long-lasting
stainless steel pipe fittings to solve your corrosion problems

All screwed Caps, Couplings, Plugs, Bushings and Unions up to and including 2" I.P.S. are machined from solid bar stock.

These fittings — sold at same price as competing 150 lb. cast fittings — can be used where working pressures of up to 1000 lbs. are experienced.

These stainless steel fittings are available in Types 304, 316 and 347.

Write TODAY for the 1951 Camco catalog and price schedules!

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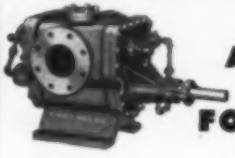
HARD-TO-HANDLE LIQUIDS ARE "DUCK SOUP" FOR A KINNEY PUMP!



Black strap molasses — one of the many materials best handled by Kinney SD Rotating Plunger Pumps — is thick, sticky, inclined to foam . . . in fact it's everything most pumps can't cope with. But it's "duck soup" for Kinney SD Pumps — the pumps that do difficult jobs easily.

If you're working with a viscous, hard-to-pump material — whether it's molasses, cup grease, soap, asphalt, white lead, or what have you — you'll find Kinney SD Pumps ready-made for your service. There are certain very definite reasons for this:

1. **Kinney SD Pumps are positive displacement pumps of high volumetric efficiency . . . capable of handling materials even under abnormally high vacuums, day after day, year after year.**
2. **Kinney SD Pumps have no valves, valve seats, springs, gaskets, or complex internal convolutions to impede the flow of liquid — to cause maintenance problems.**
3. **Kinney SD Pumps have large suction and discharge openings which are totally unobstructed . . . the ideal design for fast, effective handling of viscous materials.**
4. **Kinney SD Pumps, in a wide range of sizes, are available steam-jacketed . . . an important feature in pumping asphalt and other materials of poor cold-flow characteristics.**
5. **Kinney SD Pumps are ruggedly built to give long and reliable service.**

Send coupon today for Bulletin L48, a detailed catalog of the complete line of Kinney Rotary Liquid Pumps. KINNEY MANUFACTURING CO., Boston 30, Mass. Representatives in New York, Chicago, Cleveland, Houston, New Orleans, Philadelphia, Los Angeles, San Francisco, Seattle, and foreign countries.

Kinney LIQUID PUMPS

KINNEY MFG. COMPANY
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Please send me Bulletin L48 . . . the complete catalog of Kinney Liquid Pumps. My liquid pumping problem involves:

☐ Acid Sludge	☐ Lube Oils	☐ Molasses	☐ Tar
☐ Asphalt	☐ Edible Oils	☐ Paint, Enamel	☐ White Lead
☐ Chocolate	☐ Fuel Oils, Diesel Oil	☐ Road Oil	☐ Others (see letter
☐ Crude Oil	☐ Grease	☐ Soap, Glycerine	attached)

Name _____ Company _____

Address _____

More Accurate Level Reading of LOW TEMPERATURE LIQUIDS . . . JERGUSON Large Chamber NON-FROSTING* GAGES

YOU get the highest possible accuracy of reading on low temperature, low boiling point liquids with the patented Jerguson Non-Frosting Gage in the New Large Chamber model . . . because it insures less turbulence at the meniscus, and clear vision at the vision slot.

This new Jerguson model has 6 times larger area at the meniscus than the standard gage, so that there is a marked reduction in turbulence with light gaseous fluids that tend to boil or surge. Moreover, the problem of frosting encountered with these liquids has been eliminated by a patented frost preventing unit extending from the gage glass. This special transparent unit projects beyond the cover bolts and prevents frost from building up over the vision slot.

Here's a dual feature gage that assures greatly increased accuracy of reading for the process industries. If you have a problem with light gaseous fluids, or with gage frosting, it will pay you to investigate the new Jerguson Large Chamber Non-Frosting Gage . . . reflex or transparent.

Jerguson Large Chamber Gage, Transparent Type, with the patented Non-Frosting Gage Glass Extension. Write for literature on this gage, and on other non-frosting Jerguson models.

**Patented*

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SARAN RUBBER lined steel PIPE

For MAXIMUM RESISTANCE TO CORROSIVE LIQUIDS & GASES

Solve pipeline corrosion problems with Michigan Saran rubber-lined steel pipe. Saran rubber linings offer the highest degree of resistance to corrosive chemicals, oils, acids and solvents. Available in either fabricated light gauge steel or standard steel pipe in 10' and 20' standard lengths ranging in size from 8" up... or fabricated to your exact requirements.

For additional information on Saran rubber-lined steel pipe and fabricated or standard cast iron flanged fittings...write today to your nearest "mpc" representative or to our application engineering department.

*A development of The Dow Chemical Company

EST. mpc 1869

THE MICHIGAN PIPE COMPANY
BAY CITY, MICHIGAN

TROY Angular MIXER

Something Different in Mixing Action!

. . . an action that may give you the better mixing you must have

Effect produced by repetitive photographs of model of the mixer arranged to combine whirling action of the mixing arm with rotation of can. Note how thoroughly the entire space occupied by the batch is covered by the agitator.

Combine the unique folding-in action of the angular mixing arm with the rotational movement of the change can and its contents and you get unusual mixing action. One section of the arm, as it rotates, passes close to the bottom driving the materials to the top and when it reaches the top forces material downward again. Another section of the mixing arm sweeps the sides of the can with a rotational movement. The third section cuts through the charge in the can, with an eccentric like motion. While all this is going on, the can itself is rotating on the power driven turntable, resulting in the elimination of any dead spots or localized whirlpools. Tests and production results on many different products bear out this point. Mixing is thorough and fast.

The Troy Angular Mixer is available in two production sizes: 40 and 60 gallons. Several sizes of motors are available, the selection depending upon the nature of materials being mixed: light motors for liquids and semi-pastes; larger up to very heavy motors for heavy and extremely viscous materials. The design is such that when mixing is completed, the whole mixing mechanism can be tilted back to permit removal of the can.

TROY

Process Machinery Division

TROY ENGINE & MACHINE CO.

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OIL AND GAS BURNING EQUIPMENT FOR EVERY INDUSTRIAL APPLICATION

Whether you burn pitch, tar, oil, gas or a combination of these fuels, there's a NATIONAL AIROIL BURNER for your job.

Our more than 38 years' experience in the design, development and manufacture of all types of industrial burners is at your service.

Ask us about your requirements . . . we'll gladly give you full information.

PRODUCTS

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes; STEAM ATOMIZING OIL BURNERS; MOTOR-DRIVEN ROTARY OIL BURNERS; MECHANICAL PRESSURE ATOMIZING OIL BURNERS; LOW AIR PRESSURE OIL BURNERS; GAS BURNERS; COMBINATION GAS and OIL BURNERS; AUTOMATIC OIL BURNERS, for small process furnaces and heating plants; FUEL OIL HEATERS; FUEL OIL PUMPING and HEATING UNITS; FURNACE RELIEF DOORS; AIR INTAKE DOORS; OBSERVATION PORTS; SPECIAL REFRACTORY SHAPES.

TYPE "SA"
(For use where steam *is available*) *atomizes thoroughly* and *burns completely*, the lowest and cheapest grades of fuel oil and tar, requiring only low oil pressure and temperatures. Send for Bulletin No. 21.

TYPE "S-A-L"
(Large capacity burner similar to TYPE "S-A-R") is adaptable in combination with powdered coal burners in large boilers. Send for Bulletin No. 24.

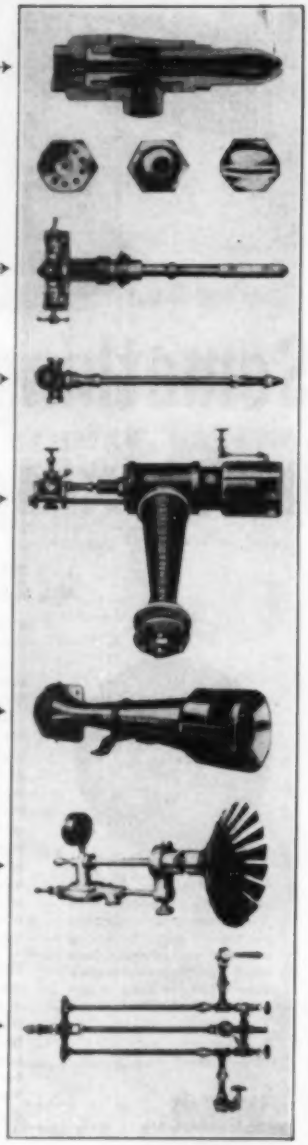
TYPE "S-A-R"
(Where steam, or gas is available for atomizing) safely and efficiently burns residuums obtained from process. Send for Bulletin No. 23.

COMBINATION GAS AND OIL BURNER
—the "AIROCOOL" Gas Burner in combination with a TYPE "S-A-R" Oil Burner Send for "AIROCOOL" Brochure.

"AIROCOOL" GAS BURNER
(Of venturi type), assures low turndown without burnback. Send for "AIROCOOL" Brochure.

MECHANICAL PRESSURE ATOMIZING OIL BURNERS
with multi-vane type air diffuser to give a positive swirl to entering combustion air. Send for Bulletin No. 13.

TYPE "S-A-D"
(Refuse Oil Burner) burns acids or caustic oils, sludges, asphalts, tank bottoms, polymer oils, heavy petrolatums, organic oil residuums, waste cutting oils, sulphite pulp liquors, tars, pitches, etc., in combination with fuel oil. Send for Bulletin No. 21.



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strapping and seals

7 A. J. Gerrard Metals and Finishes enable you to meet the corrosive conditions to which pipe lines and tanks are subjected.

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As Simply, Quickly and Easily as Taking Temperature Readings

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Write today for fully illustrated catalog showing Brookfield Viscometers adaptable to any viscosity problem *from less than one to 32,000,000 centipoises.*

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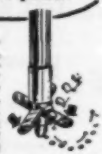

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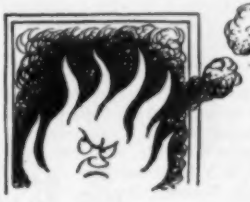
Points the finger at Hidden fires...

Slow-burning fires may smolder for hours before they generate enough heat to set off fire detecting devices. But they can be spotted within a few seconds by a *Kidde* smoke detecting system.

A single *Kidde* Multi-line Smoke Detector System can protect one room or many rooms in the same building. A central electronic control board tells the exact location of the fire—and transmits a warning to your fire control headquarters or the local fire department.

You can combine this efficient *Kidde* Smoke Detector System with a *Kidde* CO_2 Fire Extinguishing System. See your nearest Kidde representative or write for full information.



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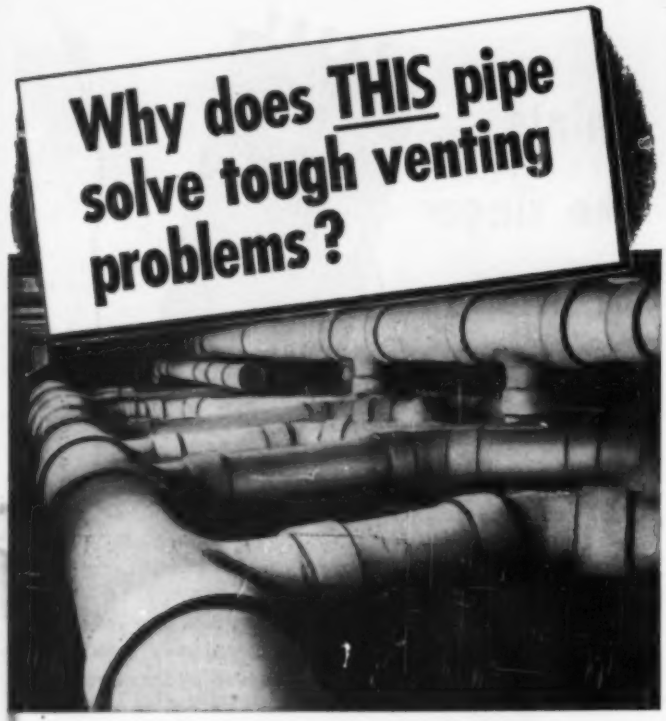

...it's made of corrosion-resistant TRANSITE*

IT'S NO SECRET why Transite* Industrial Vent Pipe has solved difficult venting problems for many plant engineers ... and thereby lowered their maintenance costs.

This tough, durable asbestos-cement pipe successfully resists many of the corrosive fumes, vapors, and gases encountered in a wide variety of industrial operations ... helps avoid frequent replacements that waste both time and money.

In addition, Transite Industrial Vent Pipe is non-metallic and therefore rustproof—needs no painting or other protective treatment. It can be used as ducts, vents or stacks in either indoor or outdoor service.

Plant men appreciate its light weight, plus the fact that it can be cut and drilled with ordinary tools. And it comes in a complete range of sizes up to 36" in diameter ... with a complete line of rustproof, corrosion-resistant fittings that adapt it to practically any job requirement.

You will find further details on Transite Industrial Vent Pipe in Data Sheet Series DS-336. For your copy write Johns-Manville, Box 290, New York 16, N. Y. In Canada, 199 Bay Street, Toronto, Ontario.

JM

*Transite is a registered Johns-Manville trade mark

Johns-Manville TRANSITE Industrial Vent PIPE

...Closer Product Control

...Lower Operating Costs

...Increased Capacity

Planned... ENGINEERED

● If new product developments have affected your operating efficiency or limited your plant capacity—call on a Ferguson First Team of qualified engineers to assist you in an expansion or modernization program. These men are selected for their training and experience in every phase of the chemical industry.

Consider complete instrumentation and mechanization for resulting lower operating costs, closer product control and increased efficiency in both processing and material handling.

Preliminary Discussions in Confidence and Without Obligation

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EXPERIENCE . . . THE FOURTH DIMENSION

COLD MIX FOR A "HOT" RED

HERE'S A BETTER WAY TO GET IT!

It's carrying coals to Newcastle to tell you how sub-cooled ice is used to lower an azo color mix temperature in order to produce precipitation, whether you want to make a hot red, a sunny yellow, a frigid blue or whatever.

It is useful to point out, however, that the dye and pigment industries are using York FlakIce ribbons increasingly for this important job of cooling.

USE FLAKICE RIBBONS

If in your own specialized fields you need crushed or sized ice, use Flakice frosty ribbons. They do a much better job.

1. **It's cheaper to use Flakice ribbons than it is to buy bulk ice.**
2. **York Flakice Machines require much less space than is needed for the storing, crushing or handling of bulk ice.**
3. **Flakice ribbons are delivered to the mix free of foreign matter which might corrode vats or contaminate mix.**
4. **The fragile Flakice Ribbons prevent damage to agitator blades.**
5. **The high ratio of surface area to weight of Flakice Ribbons results in extra rapid heat reduction of liquids and compounds.**

York FlakIce Machines range in capacity from 1 to 28 tons of ice per day. Stainless steel freezing drum and cutter, automatic "no hands" operation (from flowing water to cascading flakes of ice), assure positive sanitation. Automatic controls and built-in safety features assure high efficiency and trouble-free maintenance.

YORK FLAKICE MACHINE Model DER-150

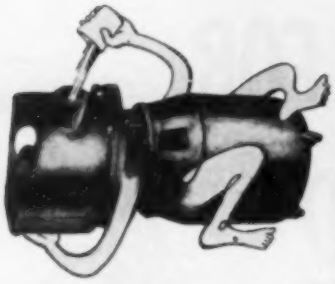
For further information, get in touch with your York Representative or write York Corporation, York, Pennsylvania

DO YOU MAKE colors . . . or chemicals . . . or frankfurters . . . or giant dams . . . or anything under the sun that requires crushed or sized ice?

York FlakIce frosty ribbons will save you money and do a better job.

The big advances come from YORK

Headquarters for— **Refrigeration and Air Conditioning**



ONLY new Goulds Self-Priming Pumps Give ALL 5 Important Advantages

1. **Absolutely no valves**—There are no valves of any kind in these pumps—nor are any needed in installation. Liquid can drain out of discharge and suction line through pump without affecting priming ability.
2. **No recirculation**—Liquid does not recirculate after completion of priming action.
3. **Top-notch efficiencies**—Efficiencies in these pumps are comparable to quality straight centrifugal pumps.
4. **Positive fast-acting self-priming**—Self-priming is similar to priming ability of positive displacement pumps.
5. **Small compact priming chambers**—No large or bulky priming chambers mean small, compact units at low cost.

SELECT THE PUMP YOU NEED FROM THIS COMPLETE LINE

INDUSTRIAL

¼ to 5 H.P. ratings, open and closed impellers. Capacities to 120 G.P.M. Heads to 135 ft., suction lifts to 25 ft. Flexible coupling, or close-cupld motor drive. Send for Bulletin 636.1.

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Compact, lightweight, with gasoline engine. Capacities to 58 G.P.M. Heads to 25 ft. Send for Bulletin 639.1.

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¼ to 5 H.P., capacities to 120 G.P.M. Heads to 135 ft. Equipped with float switch and elbow strainer. Pump is *not* submerged in pit. Send for Bulletin 627.

GASOLINE ENGINE DRIVEN

1½ to 5 H.P., open and closed impellers. Capacities and heads same as Industrial. Available in close cupld only. Send for Bulletin 638.1

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Processing of waste for feed or for efficient disposal is handled by Rietz Disintegrators on sugar beet trash. Weeds, vines, alfalfa, some whole beets, tops and tails are shredded in the Disintegrator. Trash is then dried or stored in silos for sale with plant's extracted beet pulp.

Spent hops from breweries are also finely ground for disposal. *Other products* are converted to animal feed or fertilizer through Reitz size-reduction methods.

Write for free technical bulletin on this application.

Rietz MANUFACTURING CO.

441 Folsom St., San Francisco 5, California

Smooth Vibrationless PROPELLERS

for MIXING, STIRRING AERATING, PUMPING AGITATION

A Michigan 34" Stainless Steel propeller with split hub for mounting in receptacle through manhole.

Manufactured by an exclusive process, Michigan propellers are perfectly balanced to avoid whip and strain on shafts. They are available for original equipment, replacement or special application in a wide range of materials and in sizes up to 60". Write for latest data folder.

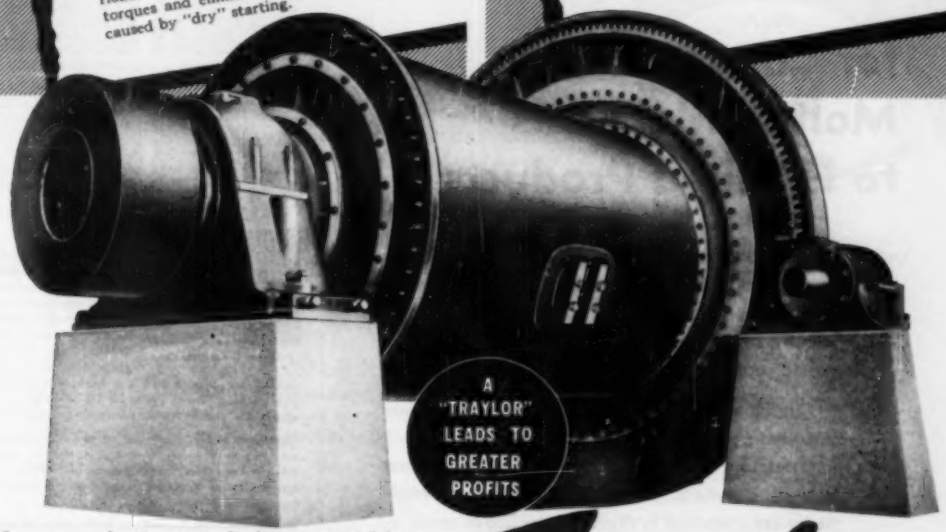
MICHIGAN WHEEL CO.
GRAND RAPIDS 3, MICH.

Here's why a Traylor Ball Mill

needs less maintenance

HEADS are cast steel . . . faced and counter bored to fit shell flanges. Shell is of all welded steel plate construction with heavy flanges welded to each end. Flanges are faced and turned to insure proper alignment with heads. Trunnions are cast integral with the heads, *turned* and *highly polished*. Large trunnion bearings . . . of heavy ball and socket design . . . are continuously lubricated by an internal oil elevator. To save power and reduce bearing wear when starting the mill, a high pressure Alemite pump is fitted to each bearing. This pump coats the trunnion with a film of grease which lifts and floats the mill to overcome high starting torques and eliminate undue bearing wear caused by "dry" starting.

GEARS are important to ball mill operating and maintenance costs. Traylor gears mesh smoothly . . . are less subject to wear . . . minimize power waste. The main gear is furnished in halves. Both this steel main gear and the steel pinion gear are reversible. Using *both sides* of the teeth greatly lengthens gear life. The teeth are generated involute with *high* addendum on the pinion . . . low addendum on the main gear . . . on a Maag Type Automatic Gear Generator. This has been *standard* practice at Traylor for over 25 years.



As your production rate climbs...your need for a Traylor Ball Mill will grow. As your grinding costs increase, so will your need for *more productive* equipment to protect your profits. Traylor Mills are built for *continuous operation...for dependable 24 hour production* with a *minimum* of down time for maintenance. Write today if you have a grinding problem due to increased production requirements. Traylor can show you how to put your grinding operation on a *profitable* 24 hour basis.

Traylor

Rotary Kilns, Coolers and Dryers • Grinding Mills
Jaw, Reduction and Gyratory Crushers • Crushing Rolls

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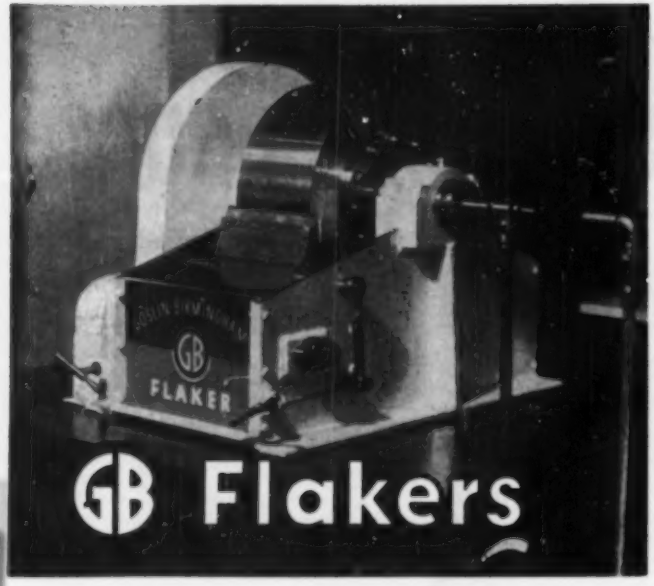


GB Flakers

for Conversion of Molten Materials to Finished Products

GOSLIN-BIRMINGHAM engineers have solved conversion problems for many plants by the application of one or more GB Flakers. Many materials which are produced in molten form can be converted profitably to finished products by flaking.

This all stainless steel research flaker has been installed by GB in its laboratory for the purpose of determining the flaking characteristics of customers' materials. Experienced GB process engineers are prepared to discuss your flaker applications and conduct flaker tests of your materials on this equipment without cost or obligation. Your inquiries are invited.

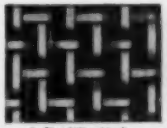
GOSLIN BIRMINGHAM MANUFACTURING CO., INC.

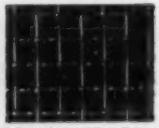
BIRMINGHAM 1, ALABAMA

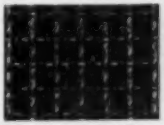
NEW YORK: Goslin-Birmingham, 350 Madison Ave.

CHICAGO: F. M. deBeers and Associates, 20 N. Wacker

9 REASONS for specifying Cambridge Industrial Wire Cloth


1. Flat Wire Mesh

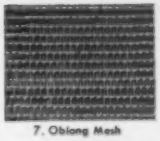

2. Single Intermediate Crimp

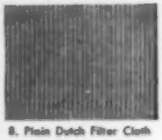

3. Double Intermediate Crimp

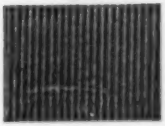
4. Double Crimped

5. Twilled Weave

6. Calendered Bucking Screen


7. Oblong Mesh


8. Plain Dutch Filter Cloth


9. Twilled Dutch Filter Cloth

9 SELECT THE WIRE CLOTH that meets your requirements best from these 9 basic Cambridge weaves. Each is available to you in any metal or alloy wire of any gauge. Mesh sizes range from 4" openings to 20 x 250 mesh, according to your needs. *Many types of Cambridge wire cloth are ready for immediate shipment.*

Close attention to each loom by individual operators during weaving is your assurance of exact mesh count. Each finished piece is carefully inspected before shipment to make certain it is free from defects.

TELL US your special problem in filtration, screening or sizing. Perhaps our facilities and experience can be combined to produce the special type of wire cloth needed.

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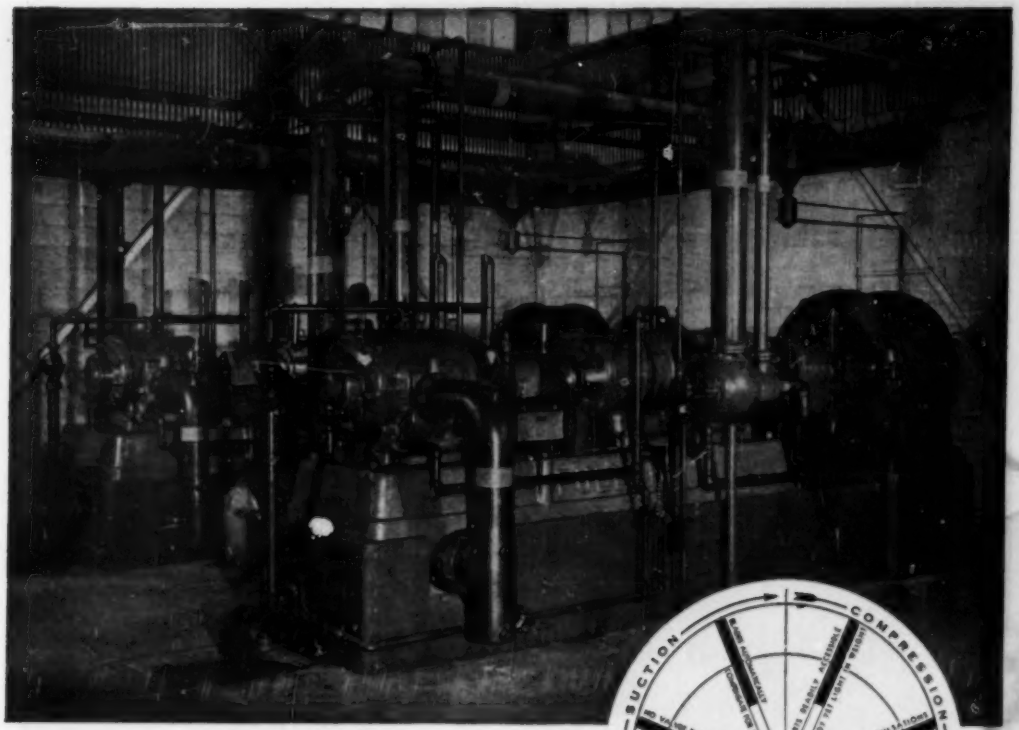

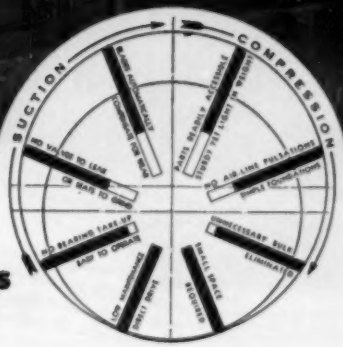

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but with FULLER rotary compressors IT NEED NOT BE COSTLY

Problem: To secure a dependable, economical source of air power for the cold-reduction sheet and tinplate mill of the Columbia Steel Co. at Pittsburg, Calif.

Solution: Two Fuller Two-Stage Rotary Compressors were installed. Each, driven by a 600-rpm. synchronous motor, delivers 1660 cfm. at 125 psig. Each is equipped with intercooler, regulator, and intake filter-silencer unit. In addition, complete full-magnetic electrical-control equipment is provided.

Fuller Rotary Compressors are built to provide a lifetime of new machine efficiency. They're sturdy, dependable—and because they have a minimum of moving parts—rotor, bearings and blades—they require minimum attention. There are no valves to leak, no seats to grind. Blades automatically compensate for wear. No detail has been overlooked that makes for long-term, trouble-free service at the lowest possible maintenance and operating costs.

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DRY MATERIAL CONVEYING SYSTEMS AND COOLERS
COMPRESSORS AND VACUUM PUMPS
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C-199

NEW HEAT SAVING EFFICIENCY

Mundet 85% Magnesia Insulation provides attractive smooth finish . . . precise fit . . . maximum strength and resistance to vibration.

New heat saving efficiency is provided by Mundet Custom Molded 85% Magnesia Pipe Covering. Extra durability is built into this insulation. It is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering. Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7111 Tonnelle Avenue, North Bergen, New Jersey.

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For Really Accurate Weigh Feeding!

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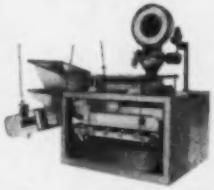
SYNTRON
"Weigh-Flow"
GRAVIMETRIC FEEDERS



—with their purely "ELECTRONIC" instantaneous correction of even the slightest variation in weight in the flow of bulk material. "Pre-determined" setting of scale automatically maintains desired weighed flow of material per unit of time.

Small sizes for weigh feeding chemical reagents—up to huge models for hundreds of tons per hour of ore, coal, limestone, etc.

Or
SYNTRON
"Automatic"
BATCH WEIGHING

Vibrators on bins and hoppers keep the materials free-flowing. The vibratory feeders automatically filling scale hoppers to exact weight and discharging onto secondary vibratory feeders, smoothly emptying each accurately weighed batch into mixers, blenders, belt conveyors etc.

Write for Catalog Data

SYNTRON CO.
810 Lexington Ave. Homer City, Pa.

Cross section of standard Redler casing shows material moving in lower run—flights returning, circuit-fashion, in upper.

REDLER Conveyors Move Cellulose Acetate with **SPEED** and **SAFETY**

Fast, safe movement, without contamination or spillage, at the lowest cost per ton is the achievement of this REDLER Conveyor System designed and installed by S-A. Automatic remote control operates the system, giving fast, convenient handling with maximum safety and economy. The logical, economical solution of problems such as this has been the continuous record of S-A engineers for fifty years. This half-century, bulk-materials-handling experience can be applied with great advantage to your own material movement questions.

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1901-1951

50 years experience with bulk handling

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Three horizontal REDLER Conveyors mounted overhead in parallel positions convey cellulose acetate from storage to weigh bins. Discharge outlets, gate-controlled, permit placing material in any selected bin. Bins discharge into mixers on floor below. Acetate flake dissolves to viscous solution from which "Eastman Acetate Yarn" and "Eastman Acetate Staple" are made. Material moved within enclosed casing of REDLERS is protected against contamination and spillage.

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

119-I

WHERE METAL SERVES UNSEEN*...
SPECIFY DAMPNEY
Chemical-plant stack, Dampney Thur-Ma-Lox protected, after three years' severe fume attack, weather exposure and operation ranging from high heat to out-of-service cold.

Surfaces inaccessible for day-to-day observation need coatings you can count on — sight unseen — for continuing protection. Just as Dampney here successfully combats chemical-fume attack under high heat, so Dampney coatings likewise guard metal serving beyond the camera's range, wherever processing equipment faces severe corrosive action.

Coatings for such service must be selected both for resistance to specific materials handled and adaptability to individual operating conditions. When you specify Dampney, you make your selection on just that basis for you buy, not an all-purpose anti-corrosive, but a coating engineered for the equipment it is to protect.

That's why Apexior, Thur-Ma-Lox and Dampney coatings have been consulting-engineer-specified for thirty-four years — why we suggest you bring your corrosion problems to Dampney — first.

* *inside tanks — evaporators — digesters — piping — filters — troughs — ducts — fermenters.*

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THE DAMPNEY COMPANY

BOSTON 36, MASSACHUSETTS

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● Save Money, Floors, Equipment and Time by using DARNELL Casters and Wheels ... Always dependable, these low-cost floor protection products have been made to give you a long life of efficient, trouble-free service.

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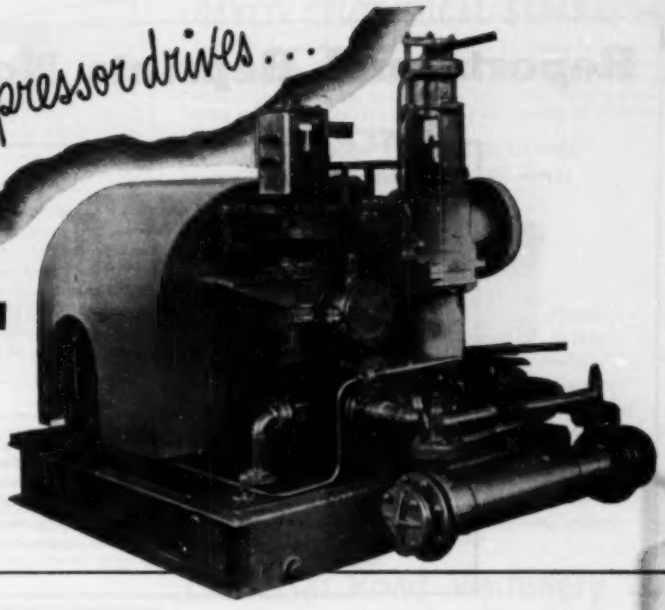

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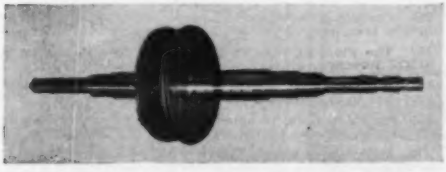

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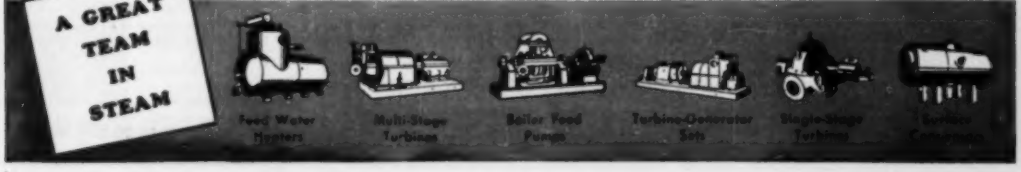

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THE GELB GIRL
JUNE, 1951

1—Tolhurst Stainless Steel Suspended type Centrifuge, 40" Imperforated Gasket.
10—Sharples Super Pressurite Centrifuges #8.
1—Sharples Super Pressurite Centrifuge, Stainless Steel Bowl, Model #16Y.
1—Jacketed Vacuum Autoclave, 600 gal. cap. with Agitator.
1—Blaw-Knox Jacketed Autoclave 3' x 4'2" with Agitator.
1—High Pressure Steel Autoclave, 900 psi., 3' x 4' with Agitator and Motor Reducer.
2—Blaw-Knox Jacketed Autoclaves with Agitators, 300 and 500 gal. cap.
1—Gomco Copper Conical Blender, 3½ cu. ft.
1—Kewanee 125 H. P. Boiler, 125 lbs. pressure.
3—Buffovak Vacuum Shelf Dryers, 5, 7, & 17 Shelves.
3—Black & Clawson Double Drum Dryers 28" x 5'.
2—Louisville Rotary Steam Tube Dryers, 6' x 50'.
2—Buffovak Vacuum Drum Dryers, 24" x 26".
2—Buffovak Vacuum Drum Dryers, 5'10" x 10'.
3—Louisville Rotary Steam Tube Dryers, 6' x 25'.
5—Buffovak Flakers 5' x 12'.
1—Ruggles Coles Direct Fired Kiln 7½' x 60'.
1—Royle #1 Perforated Extruder, with heating unit.
1—American Locomotive Stainless Steel Heat Exchanger, Model Twin Double Pipe, Size 3½ x 2T x 24.
4—Steel Heat Exchangers, 800 sq. ft. each.
1—Sperry 30" x 30" Recessed Type Filter, centrefood, open-delivery, 42 Herculite covered Plates.
3—Vallez Filters, #2E, 2B & 3.
15—Alsop Bronze & Brass Filter, Model #PAK 12-4.
1—Sperry Aluminum Filter Press, 18" x 18", 9 Chambers.
1—Sperry 42" x 42" Wooden Plate & Frame Filter Press, Closed Delivery, 54 Chambers with hydraulic closing device.
1—Shriver Cast Iron Jacketed Plate & Frame Filter Press, 36" x 36", 48 Chambers.
2—Shriver Cast Iron Filter Press, 36" x 36", Closed Delivery, 25 & 30 Chambers.
1—Sperry Cast Iron 30" x 30" Filter Press, Recessed Type, 55 Chambers, Open Delivery.
2—Sperry Tin Plated 18" x 18" Plate & Frame Filter Presses, Closed Delivery, 20 Chambers.
1—Copper Jacketed Kettle, 6' x 6' with agitator.
6—Cast Iron Jacketed Kettles, 210 to 660 gal. cap.

1—J. P. Devine Vacuum, Jacketed Kettle, 2000 Gal. cap.
9—Steel Electrically Heated Kettles, 450, 900 & 1800 gal. cap.
18—Pfaudler Jacketed Glass-Lined Kettles, 300, 400, & 1750 gal. cap.
1—Banbury Mixer #1 with 50 Hp motor.
1—Baker Perkins Double Arm Jacketed Mixer, 200 gal. cap., sigma blades.
3—Baker Perkins Double Arm Mixers, 200 gal. cap., sigma blades.
1—Patterson 5,000 gal. cap. Turbo Mixer "Unused".
2—J. H. Day Mogul Type Mixers, 2½ & 5 gal. cap.
5—Simpson #0 Intensive Mixers, "Unused".
1—Simpson #1 Mixer.
1—Day Pony Mixer, 15 gal. cap.
1—Patterson Porcelain Lined Pebble Mill, Type D, with 25 HP motor.
3—Hardinge Conical Ball Mills, 5' x 30", 5' x 22" and 6' x 22".
1—Abbe Engineering Silex-Lined Pebble Mill, 6' x 12'.
1—Abbe Engineering Buhrstone-Lined Ball Mill, 5' x 4'.
1—Ball Mill, Stone-Lined, 7' x 9'.
2—Mikro Pulverizers #1 SH.

2—Stainless Steel Jacketed Autoclaves, 300 gal. cap.
2—Patterson Kelly Jacketed Vacuum Autoclaves, 4' x 10' with Drives and Motors.
2—Stainless Steel Jacketed Reactors, 550 gal. cap. with Stainless Steel Condenser & Stainless Steel Packed Column.
1—Stainless Steel Vacuum Still, 300 gal. cap.

1—Mikro Stainless Steel Pulverizer #2 TH.
1—Pfaudler Glass-Lined Jacketed Reactor, 1,700 gal. cap.
5—Rubber-Lined Storage Tanks, 350 & 250 gal. cap.
5—Stainless Steel Storage Tanks 50, 100, & 221 gal. cap.
1—Stainless Steel Clad Storage Tank, 3, 100 gal. cap.

3—High Chrome Storage Tanks, 3,000 & 6,000 gal. cap.
5—Copper Mixing Tanks, 3, 100 gal. cap.
3—Steel Storage Tanks, 10,000 gal. cap.
2—Copper Columns, 30" x 80'.
1—J. H. Day #71 Re-Ball Jacketed Stainless Steel Gyrating Screen Cooler.
2—Orville Simpson #41, Rotex Screens.

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Stokes 2C Cream Filler and Closer.

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Standard Knapp No. 429 Carton Sealer.

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3500 gal. working cap. Steam-Jacketed, Double-Arm, Mixing Tanks for mixing, storing or processing of your materials.

Fitzpatrick Stainless Steel D Comminuter.

Baker Perkins 200 gal. Unidor S. J. Double Arm Mixer.

Baker Perkins and Readco Heavy Duty 50-150 gallon Double Arm Jacketed Mixers with Sigma or Fish Tail Blades.

F. J. Stokes, J. H. Day, New Era, Hottman Mixers, from 2 gallons up to 450 gallons, with and without Jackets, Single and Double Arm Agitators.

Day, etc. 100-2500 lbs. Powder Mixers.

85-100 gal. S. S. Jacketed and Mixing Kettles.

Ross, Day Pony Mixers, 8, 15, 40 gal.

Huhn Steam and Gas Fired Rotary Dryers.

Lehman, etc. 3 Roll Mills, 5" x 11", 12" x 30" and 16" x 40" sizes.

Allis Chalmers, Great Western Sifters.

Pony MX, ML, Auto. Duplex Labelrites; World Rotary and Straightaway Labelers.

Horix S. S. 14 head Rotary Filler.

Sweetland, Vallez, Shriver Filters.

Miller, Scandia, Hayssen Wrappers.

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3—Allbright-Nell 4'x9' Atmos. Drum Dryers.
4—Vac. Shelf Dryers, Buffalo, Devine & Stokes.
1—Buffalo Vac Drum Dryer 24x20". Also Rotary Vac. Dryers.
12—Steam, Gas & Electric Dryers, Tray, Truck & Conveyor Types.
8—Rotary Dryers, Direct & Indirect. Also Jacketed & Steam Tubes.
New Rotary Dryers, Kilns & Coolers built to order.

CENTRIFUGAL & CENTRIFUGES

5—Tolhurst 40" Suspended Type Centrifugals, Bottom Discharge, Motor Driven.
6—Centrifugals 36", 30", 40" & 48", Steel, Copper, Stainless & Rubber Lined.
12—Sharples Centrifuges #3A Stainless. Also #6.
3—De Laval Multiple Clarifiers #200, 300 & 301.

FILTERS

4—Sperry 30" corner feed Iron Filter Presses.
10—Sperry & Shriver 12", 18", 24", 30", 32", 36" & 42" Iron & Wood Filter Presses.
1—12" Bronze Filter Press. Extra 36" & 42" iron plates & frames.
4—Vallez type 49 RB, 41 Stainless covered Leaf Rotating Filters.
Sweetland & Oliver Rotary Vac. Filters.

KETTLES & TANKS

1—Doge 1000 gal. closed Agit. Jack. Kettle.
8—Jacketed Kettles 50 to 1000 gals.
2—Struthers-Wells 10 gal. Jack. Agit. Autoclaves.
1—250 gal. Lead Lined Kettle.
20—New Stainless Steel Tanks 50 to 1000 gals.
18—Stainless, Alum., Copper, Glass & Lead Lined Kettles & Tanks.
Impregnating Units, Lab. or Pilot Plant & Us.
2—Havog Tanks, 6' D. x 7' high. Like new.

PULVERIZERS & MILLS

1—200 Raymond Mill 30 HP., complete.
6—#3000 Raymond Mills.
1—Hammer Mills & Pulverizers 3 to 50 H.P.
1—Schutz-O'Neill 20" Pulverizer. Also #1.
1—Sturtevant 30" Rock Emery Mill.
1—Robinson 22" Attrition Mill.
1—Hardinge 6' x 22" Conical Ball Mill.
1—Double Roll Crusher 10" dia. x 14" face.
1—Lehman 4 Roll W. C. 12" x 36" Steel Mill.
1—Lehman & Kent 3 Roll Steel Mills, 6" x 14", 8" x 22", 9" x 32", 12" x 36" & 18" x 40".
1—9" x 24", 3 Pair High, Steel Roller Mill.
1—Hoenshel 18" x 36", 4 Roll Granite Stone Mills.
3—Abbe Pebble Mills 6' x 6', 3' x 3½' & 2' x 2½'.
8—Abbe Jar Mills Lab to 15 gal. sizes.
1—Loominster #0 Rotary Cutter.
Rotary Cutters, Mikro Pulverizer, Fitzpatrick Comminating Mills, Etc.

MIXERS—ALL TYPES

7—Baker-Perkins heavy duty double arm Jack. mixers, 200 & 0 gals.
12—Hartz, Mixers 50 to 200 gals. single & double arm.
6—Pony or Paste Mixers, 8, 15 & 40 gals.
1—Century 2 HP, 4 speed Vert. Mixer.
6—Read & Paste Mixers 50 to 150 gals.
4—Simpson Intensive Mixers #0 to 3-½.
1—Master Drum Type Blender 1000#.
10—Dry Spiral Mixers 50 to 2500#.
12—Portable Elec. Liquid Mixers ½ to 3 HP.

SCREENS & SIFTERS

2—Tyler 2½ Jr. Hummer Screens, 20"x30".
1—Rotex Sifter 20"x84", 4 Surface.
2—Gyratory suspended Sifters 20" & 24".

MISC. & SPECIALS

Stokes B preform Tablet Machine 2½" dia.
Colton 24" preform Tablet Machine 1¼" dia.
4—French Oil 600 Ton Linseed & Cottonseed Hydr. Presses.
6—French Oil Motor Driven Expellers.
New 6" x 12" Lab Mixing Mills & Calenders.
4—Farrel 15" x 36", 18" x 48", 10" x 48" & up to 22" x 60" 2 Roll Mixing Mills.
3—Rubber & Plastic Extruders 1½" to 6".
2—Stokes 2E Paste Fillers up to ½ gal.
1—Marco #200 Stainless Steel Homogenizer.
4—Stokes & Smith & Day Powder Fillers.
6—Filling Machines, Liquid, Paste & Powder.
5—Stokes & Colton Rotary & Single Punch Tablet Machines, ½" to 3".
2—Revolving Pans 30" & 36".
10—Stokes, Vert. High Vac. Pumps.
2—Worthington 12" x 12" x 12" Vac. Pumps.
6—De ine & Buffalo Vac. Pumps.
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FORK LIFT—Ross 19 HT 7500# pneu tires.

AIR COMPRESSORS—IR—7" x 6" Hor. w/motor. Curtis 4" x 4" Vert. w/motor —Receiver.

MILL—Raymond 0 with Raymond 0 w/ cyclone.

RING ROLLER MILL—Sturtevant #1.

MILLS—Hardinge 5' x 22", 5' x 36", 6' x 36", 8' x 22', w/motor.

JAW CRUSHERS—7" x 9", 12" x 26", 18" x 36".

ROLL CRUSHERS—18" x 10", 54" x 20".

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1—Baker-Perkins 150 Gal. Stainless Steel Mixer, double-arm, sigma blades, with 40 hp explosion-proof motor.
1—Baker-Perkins 100 Gal. Stainless Steel Mixer, double-arm, sigma blades, with 20 hp explosion-proof motor.
1—Day 150 Gal. Brighton Mixer.
3—Pebble Mills 40 to 500 Gal.
10—Pony Mixers 8, 15 and 40 Gal.
1—Read Lab Stainless Steel Motor Driven Dough Mixer, double-arm, sigma blades.
HIGH SPEED Roller Mills 9"x24" to 10"x60".
1—Motor Driven Belt Conveyor.
3—9" Premier Cutlers Mills, watercooled.

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Motor Driven

3—AT&M 60" centerslung, S.S.
2—AT&M 48" Suspended, steel.
2—Bird 40" Suspended, steel.
1—AT&M 42" Suspended, 316 S.S.
1—Tolhurst 30" Suspended, perforated, bottom discharge, monel.
1—AT&M 20" rubber-covered.
2—Bird 36"x30", solid bowl, Continuous, rubber-covered.
3—Bird 36"x30", 24"x38", solid bowl, Continuous, steel.
1—Baker Perkins 48" "Tar-Meer" Continuous.
3—Sharples #6, steel.
1—Sharples Misco Separator, S.S., 2 HP motor.

FILTERS

2—Oliver monel 8'x10' Rotary Vac.
2—Vallez #40 Pressure Filters, 41 leaves.
1—Sweetland #10 with 26 steel leaves.
1—Sweetland #3, stainless, 12 leaves.
6—Oliver Rotary 11'6"x18', 11'6"x14', 8'x12', 8'x8', 3'x4', 1'x1'.
1—Swenson Rotary 4'x5', steel drum.
1—Shriver 30"x36" P&F, 40 C.I. chambers.
1—Sperry 36"x36" P&F, 28 wood chambers.
2—Shriver 30"x30" Recessed, 55 chambers.
4—Shriver 30"x30" P&F, 30 chambers.
1—Sperry Aluminum 30"x30" P&F, 26 chambers, with hydraulic closure.
1—Shriver 18"x18" P&F, 15 C.I. chambers.
2—Sperry Type, 20"x20", recessed, 25 C.I. chambers.
1—Shriver 12"x12" P&F, 12 chambers.
10—Shriver Skeletons, 10" to 42".

PULVERIZERS

2—Bauer 36" Attrition Mills, each with 2-50HP motors.
1—Raymond #45 Imp. Mill.
1—Patterson 8'x16' Manganese Jacketed Ball Mill.
1—Abbe 5'x6' Manganese Jacketed Ball Mill.
5—Abbe 5'x5', 4'8"x3'6", 3'9"x3'8", 2'6"x3' Pebble Mills.
7—Patterson 6'x10', 6'x8', 4'x5', 3'8"x4', 3'x4' Pebble Mills.
1—Mikro Pulverizer #18H.
3—Colloid Mills 8" and 4" dia., S.S.
1—Williams 20"x18" Hammer Mill.
1—Jeffrey 20"x12" Type B Hammer Mill.
4—Hardinge Mills 6'x22", 5'x36", 5'x22", 4½'x16".
3—Day 18"x60", 12"x30", 9"x24", 3-Roll Mills.
3—Raymond 8', 6' and 4' Air Separators.
1—Simpson Intensive Mixer #1½.
1—Ball & Jewell #1½ Rotary Cutter.
1—Fitzpatrick Model D Comminuter, 10HP motor.

SCREENS

3—Rotex Screens 36"x60", 40"x84", 60"x 120".
4—Sprout-Waldron 40"x84" Stainless, Single Deck.
6—Tyler Hummer 3'x5'.

KETTLES—TANKS

6—2000 gal. steel jacketed agitated Kettles, 200 psi.
10—Stainless 20 to 500 gal., jacketed.
1—Stainless 300 gal. jacketed, agitated Kettle.
1—Stainless 300 gal. direct fired closed Kettle.
1—3300 gal. Horizontal rubber-lined Tank.
2—Bullovak 6' dia. Crystallizers.
3—300 gal. glass-lined jktd. Agitated Kettles.
1—Patterson 150 gal. jktd. Autoclave, 300# pressure.
1—Bullovak 300 gal. jktd. steel Impregnating Kettle.
2—Day 500 gal. steel, jacketed, agitated Kettles.

SPECIAL OFFERINGS

3—Baker Perkins 100 gal. Type JNM Double Arm Jacketed Mixers.

2—Pfaudler 2000 gal. glass-lined agitated Tanks with 10 HP motors.

1—Mojonnier double effect S.S. Evaporator 180 sq. ft.

6—200 gal. steel, jacketed, agitated Kettles, 200# pressure.

1—Link Belt 2'7"x8' Rota-Louvre Dryer, monel.

2—11'6"x18' Oliver Rotary Vac. Filters.

1—12500 gal. Hor. 10'x21'6"x 1" Pressure Tank.

2—10000 gal. Hor. welded steel Pressure Tanks, 8'x27'x1", ASME Code, 225 psi.

1—8200 gal. Hor. Steel Pressure Tank, 70"x40'x2" for 390 psi.

5—3500 gal. Hor. Steel Pressure Tanks, 5'x23'x⅜" for 300 psi.

1—Fuller C-30 Compressor.

1—16000 gal. Vert. Steel Tank 10'6"x25'x¼".

1—16900 gal. Hor. Steel Tank 9'6"x32'x9/32".

MIXERS—ALL TYPES

5—Baker-Perkins 20, 9, ½-gal., steam jacketed, Double Arm.
1—Baker-Perkins 2 gal. S.S. Double Arm.
1—Howes 2000# Horiz. Powder Mixer.
10—Day, Robinson 100# to 2000# Powder.
25—Electric Portable Agitators ¼ HP to 5 HP.
2—Ross, Porter 40 and 50 gal. Pony Mixers.
9—Day Wall Mixers, 150 gal.
1—Simpson Intensive Mixer #1½.

ROTARY VACUUM FILTERS

2—Oliver 8'x10' monel Rotary Vacuum Filters with monel valves, rubber-covered trough, agitator & repulper, complete with receivers, drives & motors.

4—Eimco 3'x1' Rotary Vacuum Filters 316 S.S. construction, complete with agitator and repulper, drives and motors.

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1—Link Belt 2'7"x8' monel Roto-Louvre Dryer with steam coil heating unit.
2—Vulcan 8'x125' Kilns, ¾" shell.
1—Traylor 54"x40' Rotary Dryer.
1—Ruggles Coles Style XB10 Rotary Dryer 70"x45'.
1—Ruggles-Coles 4'x28' Indirect Heat Rotary Dryer.
4—Louisville Rotary Steam Tube Dryers 6'x50', 6'x25', 30"x20'.
1—Adt. 5'x35' Rotary Steam Tube Dryer.

DRYERS
VACUUM and ATMOSPHERIC

4—Stokes & Buffalo Rotary Vac. Dryers 18"x42", 30"x8', 3'x15', 5'x20'.
1—Stokes Vacuum Shelf Dryer, 8 shelves, 42"x42".
1—P&S Conveyor Dryer, 9' wide x 52' long.
5—Atmospheric Double Drum Dryers, 42"x 120", 32"x108", 32"x90", 30"x84".
3—Single Drum Atmospheric, 5'x13', 4'x9', 4'x8'.
2—Devine 5'x12' Vacuum Drum.

MISCELLANEOUS

7—Stokes Vacuum Pumps, 15 to 100 CFM.
1—Milton Roy Proportioneer Pump, S.S. and Hasteloy, 10 gpm.
1—Oliver Vacuum Pump, 400 cim.
1—Stokes Combination Condenser & Receiver, 137 sq. ft.
1—Colton Tablet Machine #3½.
2—Stokes Rotary Tablet Machines DD54, DD82.
1—#1 Andersen Expeller.
2—Nash Hytor Vacuum Pumps to 400 cim.
1—Mitts & Merrill #10 Paper Shredder.
1—Knapp #429 Automatic Carton Sealer.
10—Olivite Duriron & Rubber Centrifugal Pumps, 1½ to 4".

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2 Devine 30 Shelf Double Door Vacuum Dryers; Nos. 28 and 32

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Ball & Jewell Stainless Rotary Cutter No. 1½ with 30 H.P. motor

Swenson Stainless Continuous Evaporator with Barometric Leg

Swenson Quadruple Effect Evaporator with spare body; long tube type

Robinson #4 Hammer Mill—60 H.P.

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2 Stokes Vacuum Ovens, single door; 50" x 61" x 53"

2 Stainless Steel Tumbling Batch Blenders; 23 cu. ft.

2 Herman Stainless Pressure Type Filters; 24" x 41" body

4 Horizontal Autoclaves with tracks; Capstan closure; 66" x 147"

American Ring Roll Crusher—50 H.P.

3 Bird Young Rotary Vacuum Filters; steel contacts; size 4' x 4'

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1—Pfaudler 500 gal. Glass Lined Reactor.
1—Stainless Steel 18" Bubble Cap Column.
1—Stainless Steel 6' Spray Dryer.
1—Shriver 42" Cast Iron Plate & Frame Filter Press.
1—Flaker 4' x 9' Motor Drive.
1—Stainless Steel Autoclave 75 gals. 500# int. pressure.
1—W. & P. 100 gal. Double Arm Stainless Steel Mixer.
1—Buflovak 6' Vacuum Crystallizer.

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20 only, 16" 12 only, 4"
35 only, 14" 8 only, 3"
16 only, 12"
10 only, 10"
23 only, 8"

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8—30,000 GAL. 10'6" x 31' Horiz.
74,000 & 223,000 GAL. Vert.
6—10,000 GAL. 10' x 17'2" Horiz.
4—15,000 GAL. 10'6" x 23'6" Horiz.

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PUMPS

1—Milton Roy "Worthite" Proportioning Pump 10 GPH 30 psi w. 2 HP Gear Head Motor.
8—Morris 1½" Slurry Pumps 40 GPM—30' HD.

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Buflovac Single Effect Evaporator 575 Sq. Ft. Steel Tubes.
Sperry Filter Presses, 24"x24" rubber covered.
American Ring Roll Crusher, with 50 HP Slip Ring Motor.
Steam Jacketed Kettles—Alum. S.S. Plain Steel.
2000 Gal. Aluminum Oval horizontal tank.
1500 Gal. Stainless Steel Oval horizontal tank.
3—3 Roll Mills, Kent, 16"x42".
Storage tanks, many sizes.

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1—6' x 12' ALL STAINLESS STEEL Feinc Rotary Continuous Vacuum Filter, string discharge, with blankets and STAINLESS STEEL trough, repulper, receivers, vacuum pump motors, reducers, etc. Shop #387.

1—13 x 28" Bird Continuous Solid Bowl Centrifugal, STAINLESS STEEL Bowl, bronze cover. Also 24" x 38" Centrifugal with Solid STAINLESS STEEL Tapered Bowl, other parts of Monel.

1—18" x 28" Bird Continuous Centrifugal Filter, STAINLESS STEEL horiz. basket, bronze cover with 10 H.P. motor.

1—36 x 40" Bird-Laughlin Continuous Centrifugal Filter, STAINLESS STEEL horizontal basket, 25 H.P. motor.

1—6' x 10' Oliver PRECOAT Rotary Continuous Vacuum Filter, all steel.

1—70" x 40' STAINLESS STEEL Ruggles-Coles Rotary Dryer.

1—4' x 30' STAINLESS STEEL lined Louisville Rotary Dryer with reducer and 10 H.P. motor.

2—5-roll Raymond High Side Pulverizers, including separators, exhausters, cyclones, tubular collectors and inter-connecting piping.

15—Dry Powder Mixers and Blenders, rotary and horizontal ribbon type, 100 lb. to 5000 lb. capacity.

4—Swenson-Walker Jacketed Crystallizers in 10' sections, (1—70' lo. and 3—80' lo. each with pulley driven gear reducer and 10 H.P. A.C. motor). Units are 24" I. D. x 26" high with ⅜" thick steel plate and ¼" steel jackets, steel covers and ribbon agitators.

2—Rotex Sifters, 40 x 84" deck #11 20 x 48"; also 4—No. 71 40 x 84' Roball ALL STAINLESS STEEL SIFTERS

1—MIKRO Pulverizer #1 with 7½ H.P. motor.

3—Quaker City Hammer Mills. Size M-38, each with 5 H.P. motor.

10—La Bour Centrifugal Pumps, #10W, #15W, 30 W, R-55 alloy.

9—Steel Mixing Tanks: 15 x 13', 11 x 7', 10 x 7', 5 x 4' with agitators, steam coils; 8' x 30' horizontal.

250 Ft. Approximately—SCREW CONVEYOR, 6", 12" steel encased, various lengths, motor drives. Also various lengths of Redler Conveyor.

2—Buflovak Double Drum Dryers 32" x 90" complete.

15—Jacketed Double Arm Mixers, Baker Perkins and others. 5 gals. to 50 gals. capacity.

1—Vacuum Shelf Dryer, 8 shelves 42" x 42".

3—42" All Stainless Steel Centrifugals, Amer. T&M Co., each with S/S basket, curb, casing, shaft unloader, and 40 H.P. variable speed Slip Ring 3/60/440 V. 1200 RPM motor with full controls. Suspended bottom discharge type. Now at Newark.

1—6' x 50' Louisville welded shell Rotary Steam Tube Dryer with two rows, 54 tubes. Also two 6' x 27' Davenport, same type.

1—8' x 12' Oliver Lead-Wood Vacuum Filter, Acid-Resisting.

1—4' x 8' Kennedy Ball Mill, continuous. UNUSED.

3—Oliver Vacuum Filters, incl. 8 x 12', 11'6 x 14', 11'6 x 18'.

2—ALUMINUM Sperry FILTER PRESSES: 1— 30" x 30"; 1—24" x 24", Plate and Frame, 45 chambers.

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1,800 gal., SS clad jack'td., 100 PSI.
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Sturt. 8A, 157 cu. ft., steel (2-NEW).
Conical, copper, 20", 2.7 cu. ft.

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Bird, 36"x50" cont., rubber covered, SS.
60" AT6M, SS type 316.

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Oliver, 8' x 10', 250 sq. ft., wood & steel (3).
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Oliver, 8' x 12', 300 sq. ft., all steel.
Oliver, 11'6" x 14', 500 sq. ft., wood & steel.

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48" x 40", Buffovak, steel (4).

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40 gal., SS, jack'td., 40#, hinged covers (7).

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4' x 18' x 3/16" Iowa Mfg.
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16" x 40", three roll.
32" x 12", four cage.
Stedman, four cage.
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36" x 24" Jeffrey.
B48, 3-roll, 14" x 18", spiked (NEW).

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350 gal., 3' x 6'8" x ¼",
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300 gal., 5' x 21' x ½", type 430 SS.
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13500 gal., 10' x 21'8" x 1",
15300 gal., 9' x 33' x 3/16",
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6500 gal., 76" x 27'10" Extra Heavy (30).

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18 Karbate 1" x 12' Steel Outer Jackets

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4 4500 gal. lead-lined chlorinators—3 with coils, 1 with agitator
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40 Electric Motors ¼ to 20 HP 3/60/220

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Filter: Sparkler model 14-M-S stain. steel.
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Autoclave: 16 gal. Rathevak, cast iron.
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3—40' x 10' and one 50' x 10' Thickeners, steel tanks, truss type superstructures, heavy duty rakes, 3 H.P. Gearmotors, 220/440 volt.

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1—45' 12' Door low head, welded volt—

— All with gearmotors 220/440 volt —

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1 Vacuum Pan Dryer or Graining Kettle, 10' dia. x 3' deep.

2 Pan Dryers or Graining Kettles, 10' dia. x 3' deep and 5' dia. x 30" deep.

1 Stokes #59A Vacuum Rotary Dryer, 18" dia. x 42" long, with pump and condenser.

2 Atm. Double Drum Dryers, 22" x 36".

1 Atm. Tray Dryer, 1080 sq. ft.

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Former ALCOHOL PLANT
Capacity 1200 W.G. of 190 proof alcohol per day.
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TANKS, PUMPS, ETC.
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1 Porter heavy duty jacketed double worm mixer—75 gal.

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1 Read jacketed Ribbon Mixer, 90 gal.

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2 Kux Mach. Co. Model 25 Rotary Pellet Presses, 21 & 25 punch—with motor and vari-drive.

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1 Ingersoll Rand Bronze Centrifugal Pump #5ALV, 40 HP motor, 850 GPM at 140'—NEW.

2 Ingersoll Rand Bronze Centrifugal Pumps, #1½-RVH, 25 HP motor, 300 GPM at 230'.

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20# Jacket—Vertical Agitators
3—2700 gal. cap. 7'6" dia. x 7'6" high.
3— 950 gal. cap. 63" dia. x 78" high.
Type 347 stainless steel shell; cast iron top.

70 Stainless Steel and Stainless Clad open top, steam jacketed kettles—20, 40, 60, 80, 100, 150, 200 gal. sizes.

2 Stainless Steel, type 316, closed tanks—300 gal.

20 Stainless Steel, type 304, open top tanks—6, 15, 30, 50, 60, 100, 150, 200, 300, 500 gal. sizes.

1 Stainless Steel, type 347 Autoclave or pressure tank; 250# ps, Elec. heated 850° F; 100 gal. cap., 17¼" dia. x 9' high.

3 Monel Tanks, 80 gal. bolted top, coils.

13 Glass lined Steel Tanks, horiz., 7500 gal. & 5250 gal.—Brewery lining.

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1 50 gal. Glass Lined Kettle, Jkt'd. & Agit.

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1 Steel Autoclave, 130 gal., 23" dia. x 30" deep, 300# int. ps., 100# jkt. ps., agitated.

9 ALUMINUM TANKS, closed
745, 860, 1200, 1350, 1485 gal.

1 Steel Vacuum Kettle, 300 gal. agitator, 50# all jkt.

2 Copper Vacuum Kettles, 100 gal., 48" dia., jacketed, agitated.

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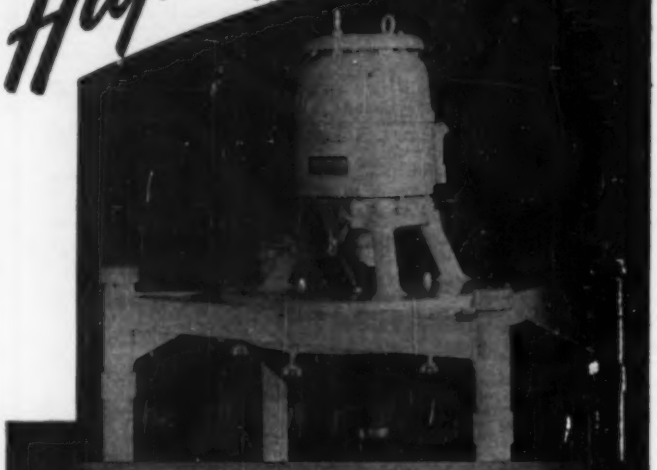

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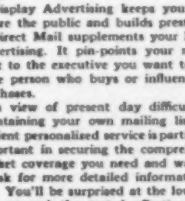

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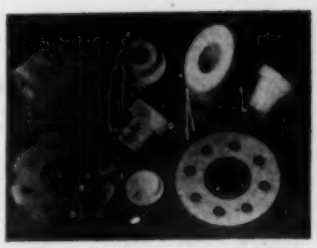

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Chemical Engineering Reader Service

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Mail the postcard below. Before mailing, circle page numbers of items about which you want more details. Then write your name and address on other side of card and mail to us. Your requests will be forwarded to companies concerned, the answer coming direct to you.

TO MAKE IT HANDY

Products and literature in this issue are listed on these pages. There are two indexes. (1) editorial items on new equipment, new products, new literature; (2) products advertised. The index of advertisers is on the proceeding page.

NUMBERS EXPLAINED

Advertisements:—There is a page number on the postcard for each advertisement. Before the number, may appear, L, R, T, B (left, right, top, bottom) locating the ad on the page; small letters following (a, b, c) indicate additional products in the advertisement.

Editorial Items:—Numerals are page numbers; the ABC's distinguish among items where more than one is on a page. There is a number on the postcard for each item in three editorial departments: Equipment News, New Products, and New Literature.

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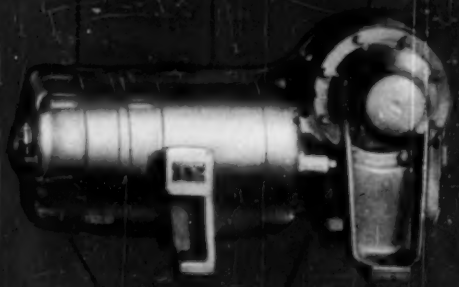

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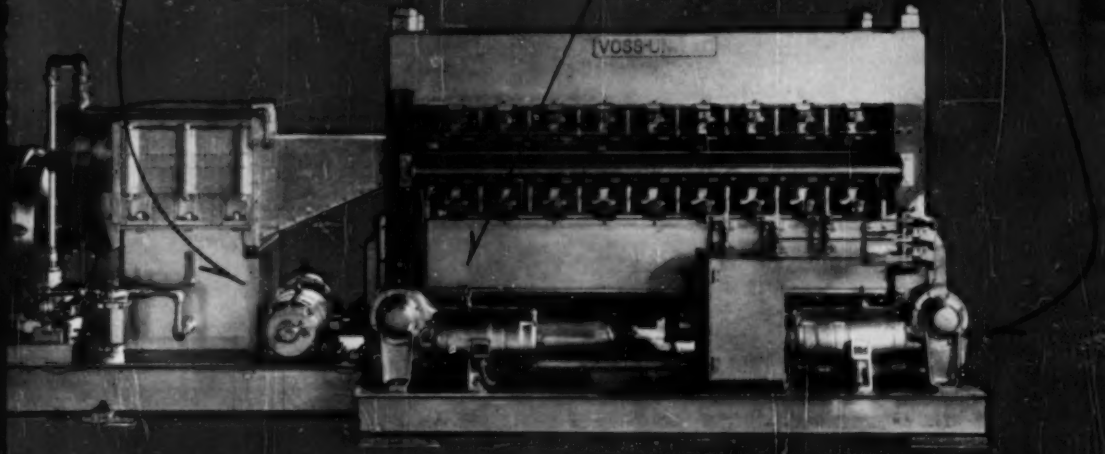

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